

**COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN II)**  
**Northern and Central California, Nevada, and Utah**  
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**Prepared For**

**U.S. DEPARTMENT OF THE NAVY**  
**Patricia McFadden, Remedial Project Manager**  
**Engineering Field Activity West**  
**Naval Facilities Engineering Command**  
**San Bruno, California**

**FIELD SAMPLING PLAN**  
**SITE 14 GROUNDWATER INVESTIGATION**  
**AND SITE 25 REMEDIAL INVESTIGATION**  
**ALAMEDA POINT**  
**ALAMEDA, CALIFORNIA**

**FINAL**

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**Prepared By**

**TETRA TECH EM INC.**  
**10670 White Rock Road, Suite 100**  
**Rancho Cordova, California 95670**  
**(916) 852-8300**

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**Neal Hutchison, Project Manager**

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## ACRONYMS AND ABBREVIATIONS

BTEX	Benzene, toluene, ethylbenzene, and xylenes
bgs	Below ground surface
CBU	Construction Battalion Unit
CLP	Contract Laboratory Program
CPT	Cone penetrometer test
CV	Coefficient of Variation
DHS	California Department of Health Services
DQO	Data quality objectives
EBS	Environmental baseline survey
EPA	U.S. Environmental Protection Agency
FSP	Field sampling plan
fpf	Feet per foot
GAP	Generation accumulation point
GPR	Ground penetrating radar
HHRA	Human health risk assessment
IDW	Investigation-derived waste
IR	Installation Restoration
IT	International Technology Corporation
JMM	James M. Montgomery Consulting Engineers, Inc.
MDRD	Minimum detectable relative difference
$\mu\text{g/L}$	Microgram per liter
$\mu\text{g/kg}$	Microgram per kilogram
$\text{mg/kg}$	Milligram per kilogram
$\text{mg/L}$	Milligram per liter
MLLW	Mean Lowest Low Water
MW	Montgomery Watson
Navy	U.S. Department of the Navy
NFESC	Naval Facilities Engineering Service Center
OD	Outside diameter
OU	Operational unit
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PID	Photoionization detector
PRC	PRC Environmental Management, Inc.
PRG	Preliminary remediation goal
QAPP	Quality assurance project plan
RI/FS	Remedial investigation/feasibility study
SOW	Statement of work
SVOC	Semivolatile organic compound
SWRCB	State Water Resources Control Board
TEPH	Total extractable petroleum hydrocarbons
TPH	Total petroleum hydrocarbons
TPPH	Total purgeable petroleum hydrocarbons
TtEMI	Tetra Tech EM Inc.
VOC	Volatile organic compound

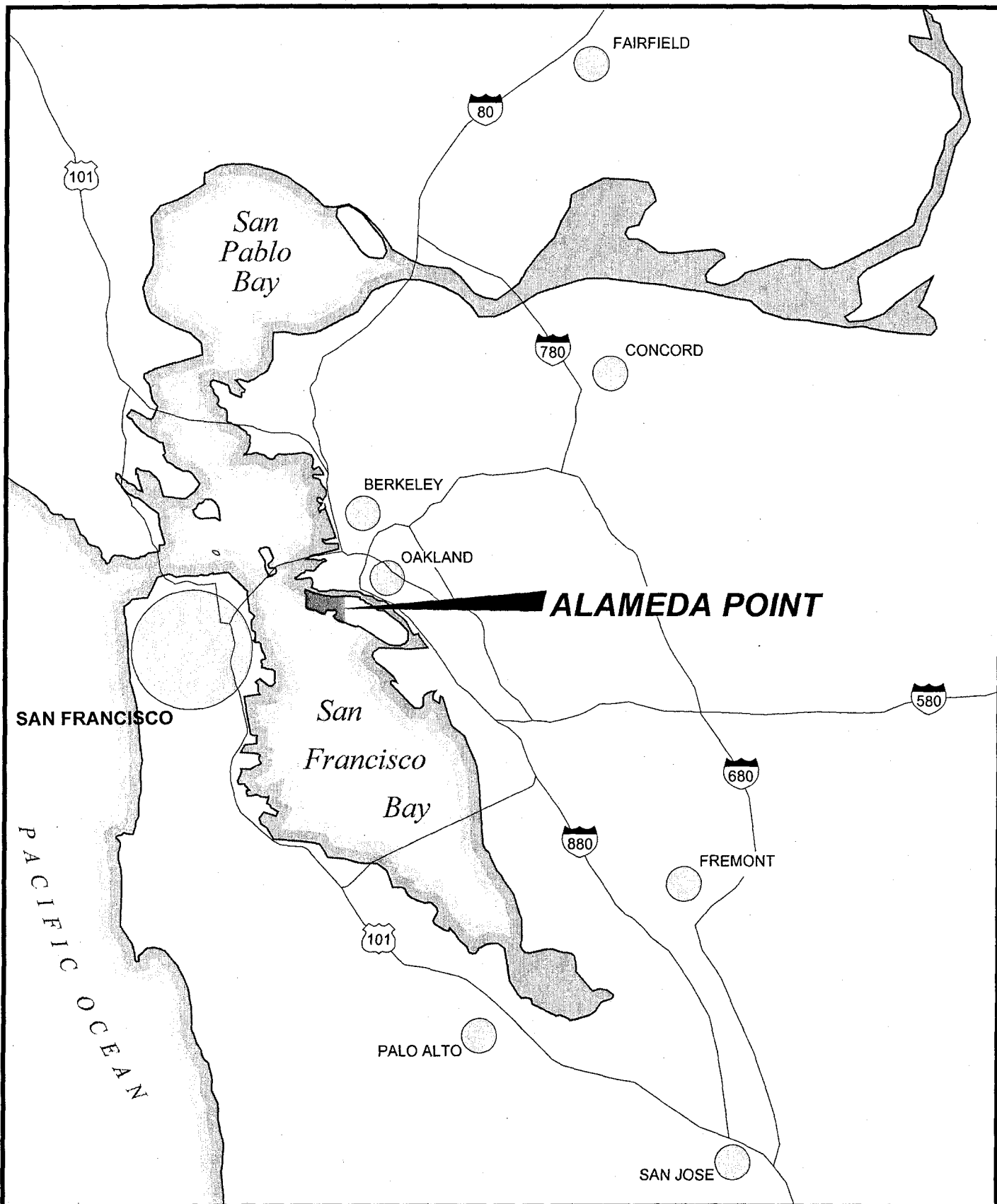


## 1.0 INTRODUCTION

This field sampling plan (FSP) has been developed in support of the following investigations at Alameda Point (formerly Naval Air Station Alameda) in Alameda, California (Figure 1): (1) a groundwater investigation at Site 14 (the former Fire Training Area), and (2) a soil and groundwater investigation at Site 25 (formerly Environmental Baseline Survey [EBS] Parcel 182). In support of the remedial investigation and feasibility study (RI/FS) process at Alameda Point, the U.S. Department of the Navy (Navy) will further assess the nature and extent of the chlorinated volatile organic compound (VOC) and total petroleum hydrocarbon (TPH) plume at Site 14, and will perform an RI at Site 25. This FSP presents the approach for investigating the chlorinated VOC and TPH plume investigation at Site 14 and for investigating the soil and groundwater at Site 25. A separate site-specific quality assurance project plan (QAPP) describing specific procedures for the collection, handling, and analysis of groundwater and soil samples is included as Appendix A.

Based on findings from previous RI/FS activities performed by the Navy in 1991, 1994, and 1995, the Navy has determined that data gaps exist at Site 14 for the chlorinated VOC and TPH plume identified south of the Fire Training Area. The Navy will use the data collected during this field investigation to determine the nature and extent of the chlorinated VOC and TPH plume in groundwater at Site 14, and for the purpose of preparing a human health risk assessment (HHRA) for the site. These data must be collected at Site 14 and evaluated prior to the completion of the northwest landfill Operable Unit (OU) 3 RI/FS.

The soil and groundwater investigation at Site 25 will be conducted based on the findings from work completed under Phase 2A of the EBS performed by the Navy in 1995, and from a limited soil investigation performed in 1997 and 1998. The results of these investigations indicated that additional data are needed at Site 25 to further evaluate (1) the nature and extent of potential soil and groundwater contamination, and (2) the potential risk to human health due to potential polynuclear aromatic hydrocarbon (PAH) contamination identified in the surface soils. Additional data must be collected at Site 25 and evaluated prior to the completion of the harbor-side OU-2 RI/FS.



APPROXIMATE SCALE IN MILES

FIGURE 1  
REGIONAL LOCATION MAP  
ALAMEDA POINT

## **2.0 SITE 14 GROUNDWATER INVESTIGATION**

This section describes (1) the history of the investigations performed at Site 14; (2) the geology and hydrogeology at the site; (3) current contaminant distribution at the site; (4) the data quality objectives (DQO) and field sampling program necessary to determine the nature and extent of the chlorinated VOC and TPH plume in the groundwater and for the purpose of preparing an HHRA; (5) groundwater sample collection; and (6) monitoring well installation.

### **2.1 DESCRIPTION AND HISTORY**

Site 14 was originally identified as the Fire Training Area, located along Perimeter Road (Figure 2). The site consists of a concrete pad surrounded on three sides by an earthen berm. The containment berm was constructed between 1973 and 1979 (Perry 1991). The site was formerly used as a fire extinguisher discharge point and a fire fighting and rescue training area. Ansulite fire-fighting foam was mixed in a nearby tank and used to extinguish training fires. A concrete sump measuring approximately 6 feet wide, 12 feet long, and 3 feet deep is located in the northeastern corner of the pad. This sump was used to collect runoff from fire training activities. During a recent investigation of the sump (Tetra Tech EM Inc. [TtEMI] 1998a), the sump was found to be intact and contains no drains or discharge points.

Based on previous RI/FS activities performed at Site 14 that identified chlorinated VOC and TPH contamination in the groundwater south of the Fire Training Area, the site boundary was enlarged to include former Building 528 and former generation accumulation points (GAP) 9a and 9b (see Figure 3). Building 528 was used by Construction Battalion Unit (CBU) 416 as a heavy equipment maintenance shop (Ecology and Environment, Inc. 1983). GAPs 9a and 9b are located south of Building 528 and were used by CBU 416 for disposal of maintenance wastes (International Technology Corporation [IT] 1998).



RI/FS activities at Site 14 included the following:

- In 1991, the Navy conducted RI/FS activities that included a geophysical survey, a soil gas survey, collection of soil samples from three soil borings, and collection of groundwater samples from monitoring wells that were converted from the soil borings. The results of the 1991 investigation are presented in the "Data Summary Report RI/FS Phases 2B and 3" (PRC Environmental Management, Inc. [PRC] and James M. Montgomery Consulting

PREVIOUS SITE 14 BOUNDARY

RUNWAY 723

## LEGEND

-  IR SITE BOUNDARY
-  Building 528 - Former Navy construction battalion heavy equipment maintenance facility

GAP Generation Accumulation Point

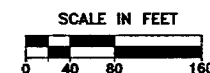


FIGURE 2

PREVIOUS SITE 14  
BOUNDARY



ALAMEDA POINT  
ALAMEDA, CALIFORNIA



CURRENT SITE 14 BOUNDARY

RUNWAY 723

## LEGEND

-  IR SITE BOUNDARY
-  Building 528 – Former Navy construction battalion heavy equipment maintenance facility

GAP Generation Accumulation Point



NORTH

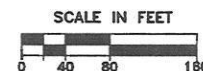


FIGURE 3

CURRENT SITE 14  
BOUNDARY

ALAMEDA POINT  
ALAMEDA, CALIFORNIA

Engineers, Inc. [JMM] 1992a). The soil gas survey detected elevated concentrations of benzene, toluene, ethylbenzene, and total xylenes (BTEX). Acetone was also detected at low concentrations in the soil. Low levels of VOCs and elevated levels of chromium were detected in groundwater samples.

- In 1994 and 1995, the Navy conducted an additional investigation of the Site 14 that included cone penetrometer testing (CPT) to determine soil lithology, groundwater sampling using a HydroPunch, collection of soil samples from 10 soil borings, and installation of one deep monitoring well. The results of the 1994 and 1995 investigations are presented in the "RI/FS Data Transmittal Memorandum for Sites 4, 5, 8, 10A, 12, 14" (PRC and Montgomery Watson [MW] 1996a). Elevated levels of total purgeable petroleum hydrocarbons (TPPH), total extractable petroleum hydrocarbons (TEPH), pesticides, polychlorinated biphenyls (PCB) (Arochlor-1260), and dioxins were detected in soil samples. Low levels of VOCs were detected in the groundwater samples collected from the first and second water-bearing zones.
- In 1994 and 1995, the Navy conducted an additional investigation of the Runway Area that included CPT, groundwater sampling using a HydroPunch, collection of soil samples from several soil borings, and installation of shallow and deep monitoring wells. The results of the 1994 and 1995 investigations are presented in the "RI/FS Data Transmittal Memorandum for Sites 1, 2, 3, Runway Area, 6, 7A, 7B, 7C, 9, 10B, 11, 13, 15, 16, and 19" (PRC and MW 1996b). Elevated levels of TPPH, TEPH, VOCs, semivolatile organic compounds (SVOC), pesticides, metals, and TPH were detected in soil samples. In the first water-bearing zone, elevated levels of petroleum- and solvent-related VOCs and low levels of SVOCs were detected in the groundwater. Carbon disulfide was also detected in several monitoring wells and most of the HydroPunch samples. In the second water-bearing zone, no industrial-related compounds were detected.

The chlorinated VOC and TPH groundwater contamination at Site 14 is located downgradient (see Section 2.2), southwest of former Building 528 and former GAPs 9a and 9b. During EBS activities, a review of aerial photographs and site inspection data indicated that undocumented spills may have occurred at several locations within and outside of Building 528. These spills may have consisted of petroleum products, solvents, and cleaners used in building operations (IT 1998). TPH and chlorinated VOC data collected during the EBS are consistent with heavy equipment maintenance activities performed by CBU 416 at Building 528 and GAPs 9a and 9b (IT 1998).

## **2.2 GEOLOGY AND HYDROGEOLOGY**

Site 14 consists of a relatively fine-grained fill material to a depth of approximately 15 feet below ground surface (bgs). This depth interval constitutes the first water-bearing zone (PRC and JMM 1992a). The fill consists primarily of silty sands and clays. Trace shell and clay fragments found throughout the fill indicate that it may be composed of dredging spoils or other marine-derived material. Below the first

water-bearing zone lies the Bay sediments from 15 to 38 feet bgs. The Bay Sediment layer consists of silty clay, with discontinuous lenses of sandy clay, and has been shown to act as a barrier against vertical contaminant migration. Figures 4 and 5 show geologic cross-sections for Site 14.

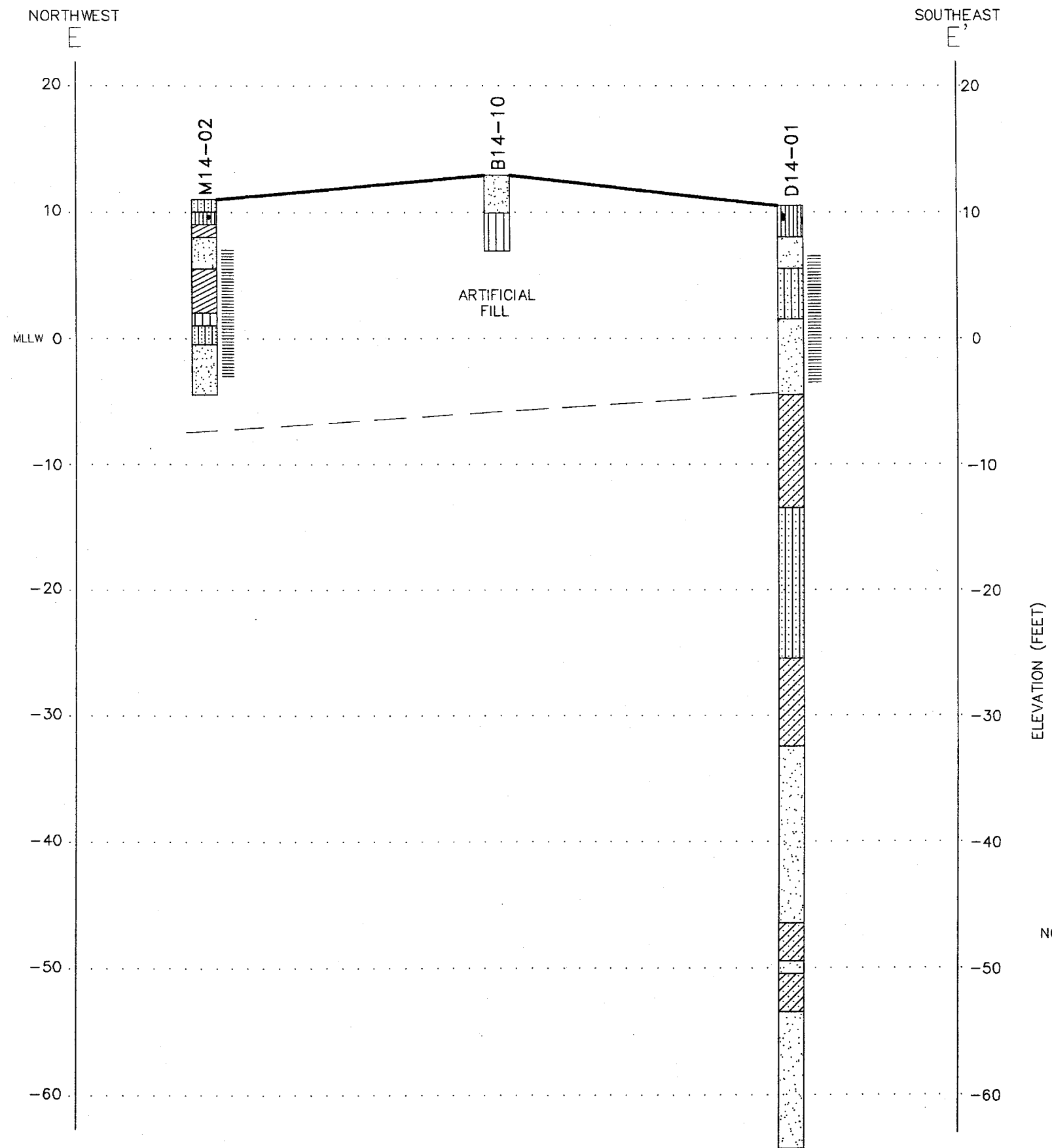
Groundwater depth at Site 14 varies from about 1 foot bgs during the wet season to 7 feet bgs during the dry season (TtEMI 1998b). During a tidal influence study performed by the Navy in late January and early February 1992, water levels in the first water-bearing zone fluctuated in response to tidal activity in the adjacent Oakland Inner Harbor (PRC and JMM 1992b). The lag time between fluctuations in the Inner Harbor and in the wells varied from about 1 hour in wells M14-01 and M14-02 to 1.5 to 2 hours in well M14-03. A tidal influence study performed in April 1992 showed no measurable tidal influences for monitoring wells M101-A and M102A (PRC and MW 1993). No tidal influence data were collected for wells M112-A, M113-A, or M114-A.

Tidally-corrected water elevations were used to calculate the following summary of groundwater flow characteristics based on April 1998 data:

Hydraulic Parameters for First Water-Bearing Zone	
General Flow Direction	Northwest
Horizontal Hydraulic Gradient	$5.3 \times 10^{-3}$ feet/foot (fpf) (average)
Estimated Horizontal Flow Velocity	27 feet/year (average)
Maximum Vertical Hydraulic Gradients between the first and second water-bearing zones	$6.8 \times 10^{-2}$ fpf (down)

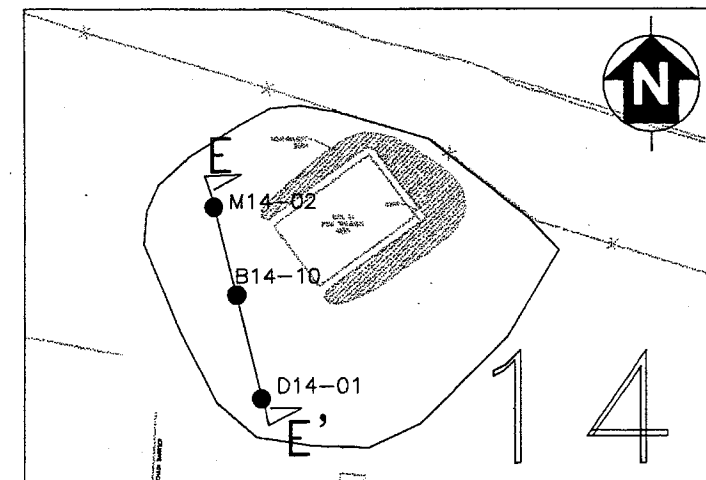
The horizontal gradients were calculated using monitoring wells M14-03, M112-A, and M113-A ( $4.5 \times 10^{-3}$  fpf), and wells M112-A, M113-A, and M101-A ( $6.2 \times 10^{-3}$  fpf). The horizontal flow velocity was estimated for the first water-bearing zone using an effective porosity of 0.30 for poorly graded sand. Local recharge from precipitation and the seasonal variation in groundwater elevations at Site 14 impacts the groundwater flow directions. During the rainy season groundwater flow is generally towards the Oakland Inner Harbor. During dry periods the hydraulic gradient can change directions resulting in flow inland from the harbor.

SITE 14-EE.DWG - 02/11/97 - CTR - 044-0316RRIP



LEGEND

- GM - SILTY GRAVELS
- SP - POORLY-GRADED SAND
- SM - SILTY SANDS
- SC - CLAYEY SANDS
- ML - SANDY SILTS, SILTY CLAYS
- CL - SANDY CLAYS, SILTY CLAYS
- CONTACT
- INFERRED CONTACT
- APPROXIMATE WATER LEVEL MEASURED DURING DRILLING ACTIVITIES
- MONITORING WELL SCREENED INTERVAL



DETAIL AREA

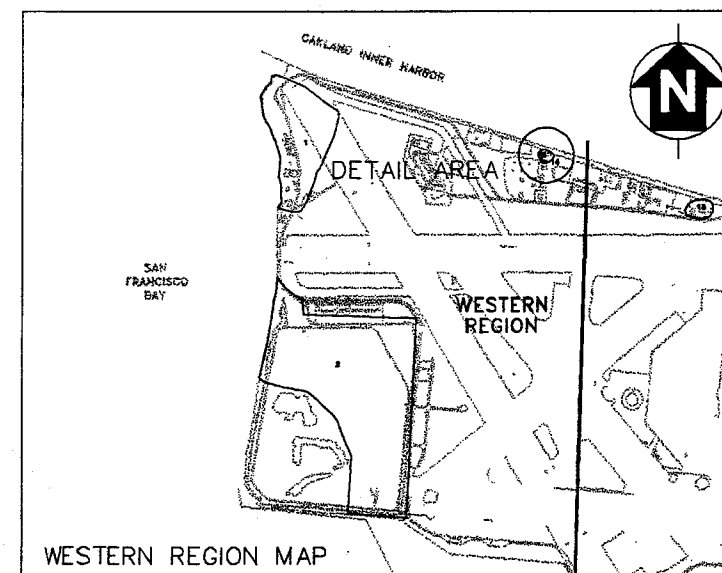
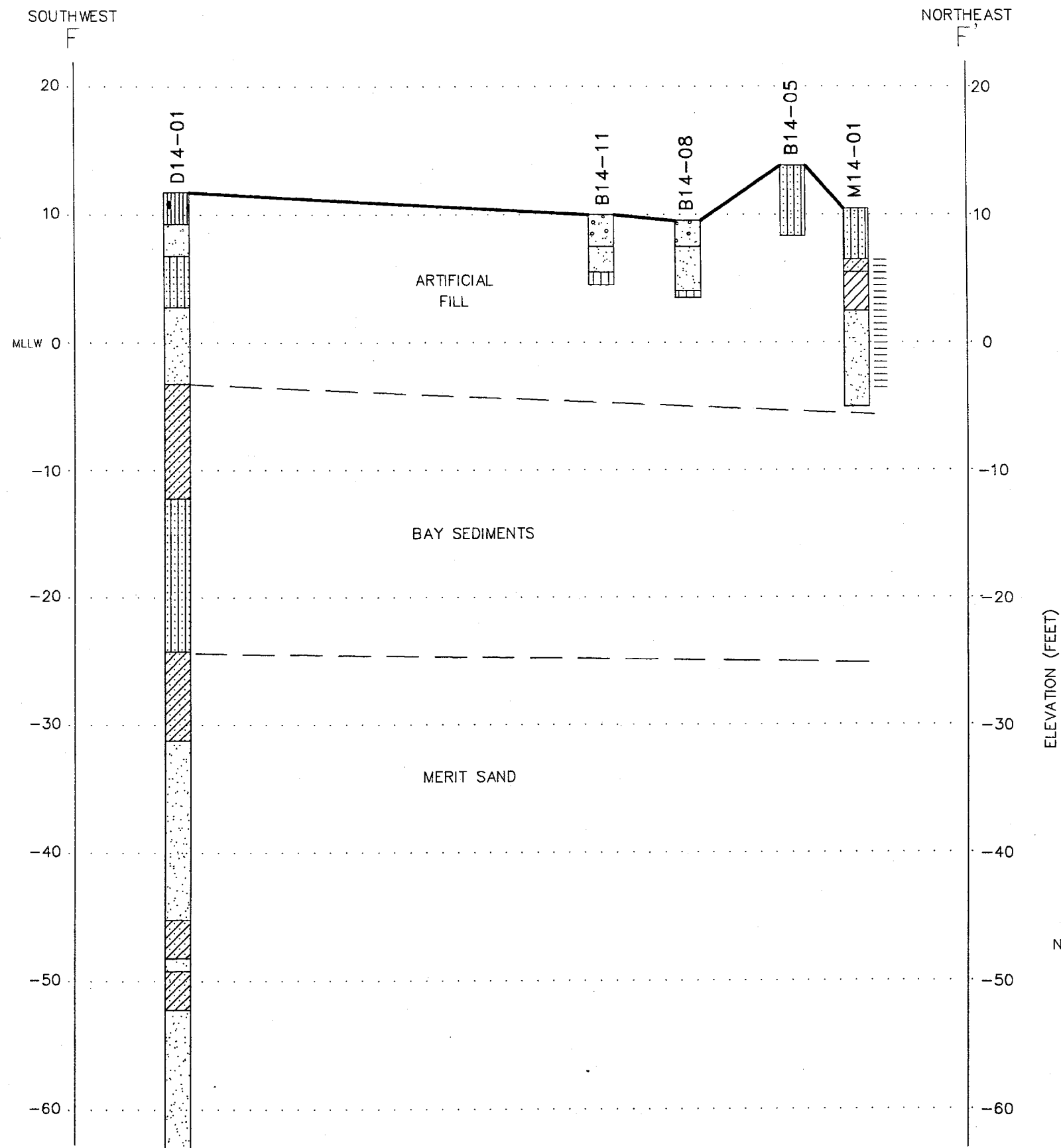


FIGURE 4  
GEOLOGICAL CROSS SECTION E-E'  
WESTERN REGION  
ALAMEDA POINT  
ALAMEDA, CALIFORNIA

15' 0 15' 30'  
HORIZONTAL SCALE: 1" = 30'

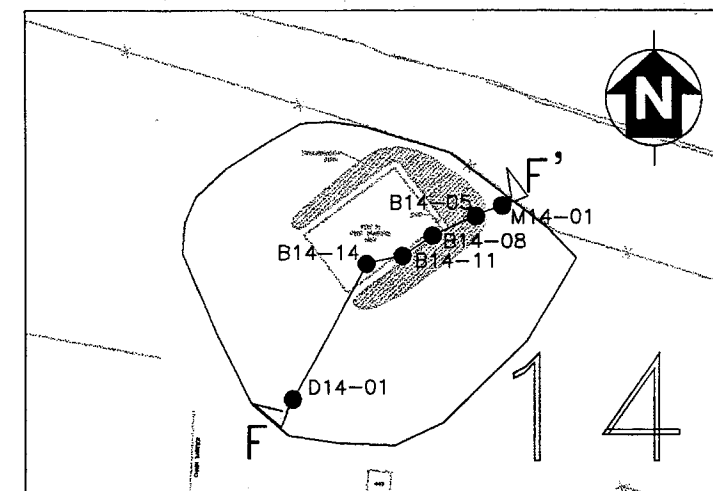


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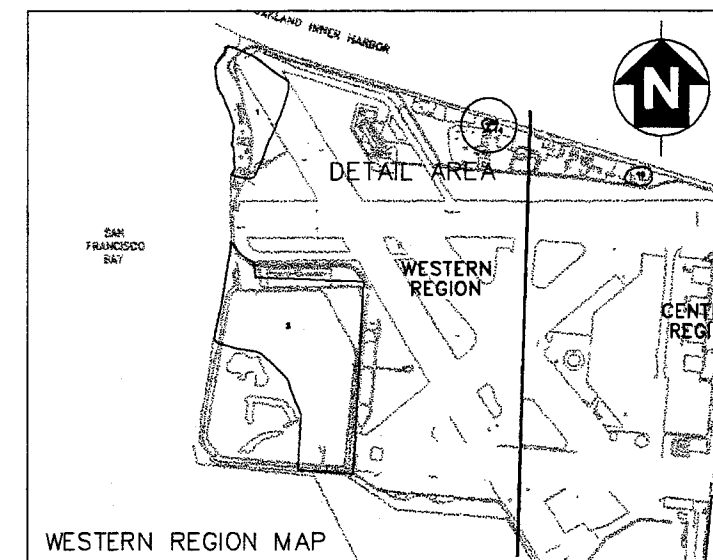


LEGEND

- GM - SILTY GRAVELS
- SW - WELL-GRADED SANDS
- SP - POORLY-GRADED SANDS
- SM - SILTY SANDS
- SC - CLAYEY SANDS
- ML - SANDY SILTS, SILTY CLAYS
- CL - SANDY CLAYS, SILTY CLAYS
- CONTACT
- INFERRED CONTACT
- APPROXIMATE WATER LEVEL MEASURED DURING DRILLING ACTIVITIES
- MONITORING WELL SCREENED INTERVAL



DETAIL AREA



WESTERN REGION MAP

NOTE: VERTICAL EXAGGERATION IS 3X.

15' 0 15' 30'  
HORIZONTAL SCALE: 1" = 30'

FIGURE 5  
GEOLOGICAL CROSS SECTION F-F'  
SITE 14  
ALAMEDA POINT  
ALAMEDA, CALIFORNIA

Downward vertical gradients were determined using monitoring wells M14-03 and D14-01 ( $6.8 \times 10^{-2}$  fpf) and M101-A and M101-C ( $1.1 \times 10^{-3}$  fpf) using April 1998 groundwater elevation data.

Two storm drain lines in the northwest corner of the site which discharge to the harbor may also influence local groundwater elevations and flow directions. These storm drain lines may also influence local flow velocities by acting as preferential flow paths.

### 2.3 OBSERVED PATTERN OF CONTAMINATION

As shown on Figure 6, monitoring wells located in the redefined site boundary include M14-01, M14-02, M14-03, M101-A, M101-C, M112-A, M113-A, and M114-A. With the exception of M101-C, the listed monitoring wells are screened in the first water-bearing zone. Monitoring well M101-C is screened in the second water bearing zone. Groundwater data collected from these monitoring wells in 1996 indicated the presence of a chlorinated VOC and TPH plume south of the Fire Training Area, near former Building 528 and former GAPs 9a and 9b. The analytical results indicated elevated concentrations of several chlorinated VOCs and heavy petroleum hydrocarbons; the highest concentrations consisted of trichloroethene at 13 micrograms per liter ( $\mu\text{g/L}$ ), tetrachloroethene at 22  $\mu\text{g/L}$ , 1,1-dichloroethane at 130  $\mu\text{g/L}$ , vinyl chloride at 390  $\mu\text{g/L}$ , and cis- and trans-1,2-dichloroethene (1,2-dichloroethene) at 460  $\mu\text{g/L}$  in monitoring well M101-A, and TPH-motor oil at 1,800  $\mu\text{g/L}$  in monitoring well M113-A. Additional information for trichloroethene, total 1,2-dichloroethene, vinyl chloride, and TEPH is provided below.

**Trichloroethene:** Trichloroethene was detected in soil from 2.2 to 5.5 feet bgs with a maximum concentration of 140 micrograms per kilogram ( $\mu\text{g/kg}$ ) at 2.5 feet bgs from soil boring M101-C. A maximum groundwater concentration of 13  $\mu\text{g/L}$  for trichloroethene was detected in well M101-A. Trichloroethene was not detected in any groundwater samples collected from wells M112-A, M113-A, and M114-A.

**1,2-Dichloroethene:** 1,2-Dichloroethene was detected in soil from 2 to 5.5 feet bgs with a maximum concentration of 190  $\mu\text{g/kg}$  at 2.5 feet bgs from soil boring M101-C and at 2.5 feet bgs from soil boring M113-A. The maximum concentration of 1,2-dichloroethene (460  $\mu\text{g/L}$ ) was detected in the groundwater sample collected from well M101-A in the first water-bearing zone. 1,2-Dichloroethene was not detected in any groundwater samples collected from wells 112-A and M114-A.

**Vinyl Chloride:** Vinyl chloride was not detected in soil from borings M101-C, M112-A, M113-A, and M114-A. Vinyl chloride was detected in groundwater from monitoring wells M101-A, M112-A, and M113-A. A maximum vinyl chloride concentration of 390  $\mu\text{g/L}$  was detected in a

M14-02	Analyte	Concentration	Units	Date
VOC	Trichloroethene	4	µg/L	AQ4
	1,2-Dichloroethene (Total)	0.2J	µg/L	AQ4
TPH	Extractable	170J	µg/L	AQ1

M14-01	Analyte	Concentration	Units	Date
VOC	Trichloroethene	0.4J	µg/L	AQ4
	1,1-Dichloroethene	0.5J	µg/L	AQ2
	1,2-Dichloroethene (Total)	2J	µg/L	AQ1
TPH	Extractable	1,700J	µg/L	AQ3

M113-A	Analyte	Concentration	Units	Date
VOC	1,1-Dichloroethene	5	µg/L	AQ4
	1,2-Dichloroethene (Total)	38	µg/L	AQ2
	Vinyl Chloride	160	µg/L	AQ2
TPH	Extractable	1800J	µg/L	AQ1
	Purgeable	72J	µg/L	AQ2

M14-03	Analyte	Concentration	Units	Date
VOC	None Detected			
TPH	Extractables	150J	µg/L	AQ1

M112-A	Analyte	Concentration	Units	Date
VOC	1,1-Dichloroethene	1	µg/L	AQ1
	1,2-Dichloroethene (Total)	190	µg/L	AQ4
	Vinyl Chloride	13J	µg/L	AQ1
TPH	Extractable	960J	µg/L	AQ1
	Purgeable	92J	µg/L	AQ1

M101-C	Analyte	Concentration	Units	Date
VOC	None Detected			
TPH	None Detected			

M101-A	Analyte	Concentration	Units	Date
VOC	Tetrachloroethene	22	µg/L	AQ2
	Trichloroethene	13	µg/L	AQ2
	1,1-Dichloroethene	130	µg/L	AQ1
	1,2-Dichloroethene (Total)	460	µg/L	AQ1
	Vinyl Chloride	390J	µg/L	11/07/97
TPH	Not Analyzed			

M114-A	Analyte	Concentration	Units	Date
VOC	None Detected			
TPH	None Detected			

M102-A	Analyte	Concentration	Units	Date
VOC	None Detected			
TPH	None Detected			

## LEGEND

- IR SITE BOUNDARY
- Building 528 – Former Navy construction battallion heavy equipment maintenance facility
- GAP Generation Accumulation Point
- ⊕ MONITORING WELL LOCATION

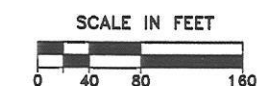


FIGURE 6

VOLATILE ORGANIC COMPOUND  
AND TOTAL PETROLEUM  
HYDROCARBON CONCENTRATIONS  
(µg/L) IN GROUNDWATER, SITE 14

ALAMEDA POINT  
ALAMEDA, CALIFORNIA

sample collected from well M101-A in the first water-bearing zone. Vinyl chloride was not detected in any groundwater samples collected from Wells M101-C and M114-A.

**TEPH:** TPH-motor oil was detected in surface soil samples collected from soil borings M101-C, M113-A, and M114-A. A maximum concentration of 440 mg/kg for TPH-motor oil was detected in a surface soil sample collected from soil boring M113-A. In soil boring M101-C, TPH-diesel was detected at 2.5 feet bgs at a maximum concentration of 390 mg/kg. In groundwater, a maximum concentration of 1780 µg/L for TPH-motor oil was detected in monitoring well M113-A. TPH-motor oil was also detected in the groundwater sample collected from monitoring well M112. TPH-diesel was not detected in any groundwater samples collected.

Based on the soil and groundwater data presented above, the chlorinated VOC and TPH plume appears to be moving laterally in a southwest direction. The chlorinated VOC and TPH plume remains undefined at depths greater than 15.5 feet bgs and is only partially defined laterally in the first water-bearing zone (ground surface to 15 feet bgs).

## **2.4 DATA QUALITY OBJECTIVES, ANALYTICAL PARAMETERS AND METHODS, AND SAMPLING DESIGN FOR SITE 14**

This section describes the DQOs, selection of analytical parameters and methods, and selection of the sampling design and the statistical methodology used in determining the quantity of samples necessary to meet the DQOs for the groundwater investigation at Site 14.

### **2.4.1 Data Quality Objectives**

This investigation will collect data to (1) evaluate the nature and extent of the chlorinated VOC and TPH plume in the groundwater at Site 14, (2) support an HHRA for the site, (3) characterize potential contaminant sources at the site, and (4) to assess whether past hazardous waste storage activities have impacted the environment at GAPS 9a and 9b under the Resource Conservation and Recovery Act. To meet these DQOs, on-site screening data and definitive data will be collected.

To determine the extent of the groundwater contamination at Site 14, a minimum of 56 depth-discrete groundwater samples will be collected in areas where data gaps are present. These samples will be analyzed using field screening and off-site laboratory analyses. To support the HHRA for Site 14, 15 percent of the groundwater samples, or a minimum of 15 total, will be sent to an off-site laboratory for generation of definitive data. Based on an evaluation of the groundwater data, additional subsurface soil

samples may be collected to identify and confirm potential sources of the contamination. These soil samples will be sent to an off-site laboratory for generation of definitive data. In addition, to assess whether past hazardous waste storage activities have impacted the environment at GAPs 9a and 9b, five surface soil samples will be collected at each of the GAP sites where contaminants may have migrated during waste handling operations. These surface soil samples will be sent to an off-site laboratory for generation of definitive data.

#### **2.4.2 Selection of Analytical Parameters and Methods**

Groundwater samples will be collected and analyzed for chlorinated VOCs and TEPH. Since low level SVOC contamination is present in the groundwater (PRC and MW 1996b), groundwater samples also will be collected for SVOC analysis. Although heavy metal contamination can be associated with heavy equipment maintenance activities, metals concentrations in the groundwater at Site 14 were within typical background levels for Alameda Point (see Appendix B); therefore metals analyses will not be performed. During previous investigations, pesticides and PCBs were not detected in the groundwater at Site 14; therefore, pesticide/PCB analyses will not be performed.

Based on EBS data collected at GAP sites 9a and 9b (IT 1998), soil samples collected at the GAP sites will be analyzed for VOCs, SVOCs, total metals, and TEPH.

**On-Site Analyses:** To expedite the groundwater investigation at Site 14, groundwater samples collected will be analyzed for VOCs and TEPH by an on-site mobile laboratory using a modified version of SW-846 Method 8260 and SW-846 Method 8015 (U.S. Environmental Protection Agency [EPA] 1986) modified for semivolatile petroleum hydrocarbons (California State Water Resources Control Board [SWRCB] 1988) (from this point forward referred to SW-846 Method 8015M), respectively. The following analytes will be reported:

- Volatile Chlorinated Hydrocarbons: Tetrachloroethene, Trichloroethene, 1,1,1-Trichloroethane, 1,1-Dichloroethene, cis and trans-1,2-Dichloroethene, 1,1-dichloroethane, and vinyl chloride
- TEPH: Diesel- and motor oil-range petroleum hydrocarbons

On-site laboratory data will provide rapid results for decision-making in the field and will allow the Navy to determine the vertical and lateral extent of the chlorinated VOC and TEPH contamination in real-time.

**Fixed Laboratory Analyses:** VOC and SVOC samples collected in support of the HHRA will be shipped to a DHS-certified and NFESC-approved off-site laboratory and analyzed in accordance with the Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Analyses, EPA document number OLM03.1 (EPA 1994). TEPH confirmation samples will be shipped to a DHS-certified and NFESC-approved off-site laboratory and analyzed in accordance with SW-846 Method 8015M.

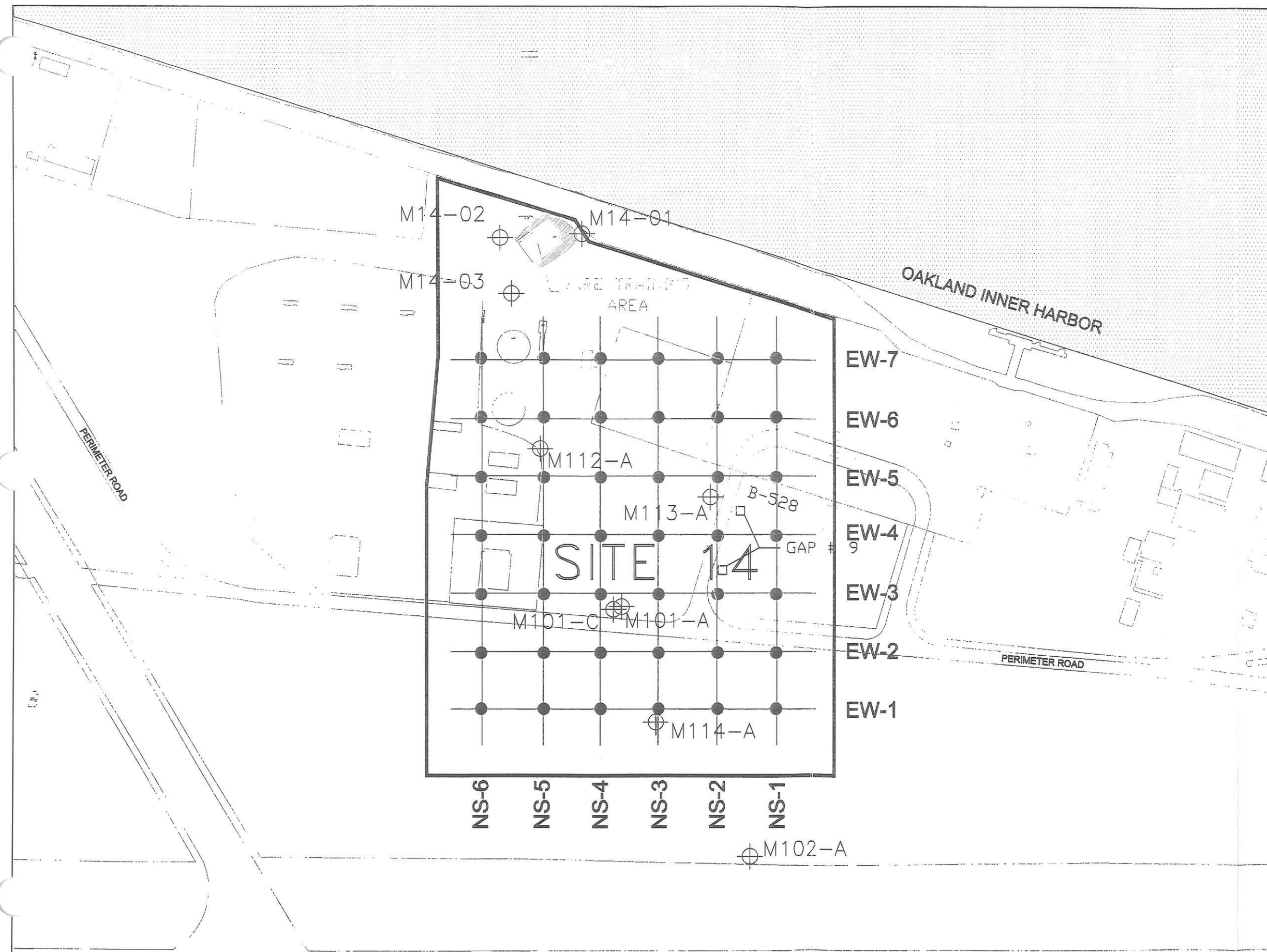
Surface soil samples collected at GAPS 9a and 9b will be shipped to a DHS-certified and NFESC-approved off-site laboratory and analyzed for VOCs and SVOCs in accordance with the CLP SOW for organics, total metals in accordance with the CLP SOW for Inorganic Analysis, EPA document number ILM04.0 (EPA 1995), and TEPH in accordance with the SW-846 Method 8015M.

The off-site laboratory will also perform all analytical methods and procedures in accordance with TtEMI's Laboratory Services SOW (PRC 1995a). Detailed descriptions of off-site laboratory procedures, analytical methodologies, and a sample identification table for Site 14 are provided in the QAPP (Appendix A).

#### **2.4.3 Sampling Design**

To determine the extent of the groundwater contamination at Site 14, based on previous chlorinated VOC plume investigations performed at Alameda Point (TtEMI 1998a), a fixed sampling grid with a spacing of 100 feet square was chosen for this investigation. Sampling locations on the grid will be identified by the two transects that the sample boring intersects. The first number will be the number of the east-west transect line, the second number will be the north-south transect line, and the third will be the depth at which the sample was collected. For example, the soil boring identification 3-4-10 would indicate that the boring is located at the intersection of the third east-west transect and the fourth north-south transect and the sample was collected at a depth of 10 feet bgs. The sampling grid for Site 14 is presented on Figure 7.





LEGEND

- IR SITE BOUNDARY
- ⊕ MONITORING WELL LOCATION
- SAMPLING LOCATIONS

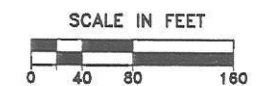


FIGURE 7

SAMPLING GRID  
SITE 14

ALAMEDA POINT  
ALAMEDA, CALIFORNIA

Based on data gaps identified from previous investigations, initial groundwater samples will be collected at four depths from 14 sampling locations, for a minimum of 56 depth-discrete groundwater samples. The shallowest sampling depth at any boring location will be at the groundwater interface, which during the dry season is approximately 8 feet bgs. At each specific location, groundwater samples will be collected in 2-foot intervals from 8 to 14 feet bgs (initial sampling locations and depths for Site 14 are listed in Table 1). Based on the field analytical data for chlorinated VOCs from the initial samples and using decision criteria explained below, additional groundwater samples may be collected from other sampling locations identified on the grid. Based on (1) past solvent plume definition investigations and (2) the nature of the bay sediments to retard the mobility of contaminants to vertical migration (TtEMI 1998a), it is estimated that the maximum depth of the investigation will be to 14 feet bgs at all sampling locations, for a maximum possible total of 168 groundwater samples.

The decision to collect additional "step-out" samples, vertically and laterally, will be based on the field-screening results for chlorinated VOCs from groundwater samples collected at the initial sampling locations. The decision rules for vertical and lateral sample collection during this sampling event are as follows:

- If the concentration of the maximum detected chlorinated VOC in the current sample is greater than or equal to 1 milligram per liter (mg/L), sampling of the next step-out locations will be omitted. Samples will be collected from the second closest step-out locations. (The decision to omit a sampling location based on the above criteria is based on groundwater plume characteristics. If the concentration in a sample is greater than or equal to 1 mg/L, the chemical generally will disperse [based on concentration gradients and advection] greater than 150 feet unless a hydraulic barrier is present.)
- If the concentration for the maximum detected chlorinated VOC in the current sample is greater than or equal to 25 µg/L and less than 1 mg/L, the next step-out samples will be collected from the nearest boring locations.
- If the concentration for the maximum detected chlorinated VOC in the current sample is approximately 10 percent of the concentration of the same chlorinated VOC detected in the previous boring location, and the concentration of the same chlorinated VOC in the previous boring location is between 25 µg/L and 1 mg/L, no further step-out samples will be collected.
- If the concentration for the maximum detected chlorinated VOC in the current sample is less than or equal to 25 µg/L, no further step-out samples will be collected.

The 100-foot grid spacing and the decision criteria specified above will be adequate to provide good definition of the contamination plume, and will allow for the determination of a "nondetect" contour line



**TABLE 1**  
**INITIAL GROUNDWATER SAMPLING LOCATIONS AND DEPTHS**  
**SITE 14**  
**ALAMEDA POINT**

Boring Number	Sample Depth (feet)			
	8	10	12	14
1-1				
1-2				
1-3				
1-4				
1-5				
1-6				
2-1				
2-2				
2-3				
2-4	X	X	X	X
2-5				
2-6				
3-1				
3-2				
3-3	X	X	X	X
3-4	X	X	X	X
3-5	X	X	X	X
3-6				
4-1				
4-2	X	X	X	X
4-3				
4-4	X	X	X	X
4-5				
4-6				
5-1	X	X	X	X
5-2	X	X	X	X
5-3	X	X	X	X
5-4				
5-5	X	X	X	X
5-6				
6-1				
6-2	X	X	X	X
6-3				
6-4	X	X	X	X
6-5	X	X	X	X
6-6	X	X	X	X
7-1				
7-2				
7-3				
7-4				
7-5				
7-6				

**Note:**

Boring numbers refer to the intersection of the transects where the boring will be advanced, i.e.  
 Boring 2-4 refers to the boring at the intersection of east-west transect 2 and north-south transect 4.

for both chlorinated VOCs and TPH. Based on (1) the hydraulic conductivity, bulk soil density, hydraulic gradient, and fraction of organic content determined during the Phase 2B and 3 RI/FS investigation (PRC and JMM 1992a); (2) published values for porosity, first order vinyl chloride decay constants, and the linear soil partition coefficient; and (3) the achievable field laboratory detection limit for vinyl chloride of 1.0 ug/L, a vinyl chloride concentration of 100 ug/L detected in the groundwater at Site 14 will degrade (downgradient) within 10 feet. Therefore, if vinyl chloride is detected at a concentration of 25 ug/L or less (the limit at which no additional step-out samples will be collected), there is no additional benefit to performing additional step out sampling and a "non-detect" line can be inferred.

If chlorinated VOCs are detected in samples collected from the borings located at the outer limits of the grid, additional grid lines will be added as necessary. In the event that the intersection of a north-south transect line and an east-west transect line is located in an area where a boring cannot be advanced, the boring location will be moved along the transect line to the nearest location where a boring can be advanced. Several factors can affect the location of a boring, including underground utilities, overhead obstacles, and proximity to a building or other structure. Any changes in transect locations or sampling locations will be discussed among the on-site geologist, the field oversight task manager, and if necessary, the Navy project manager.

To support the HHRA for Site 14, groundwater data will be used to calculate the 95 percent upper confidence of the arithmetic mean (95UCL) concentration, which is the concentration used to estimate risks from human exposure (EPA 1992). In order to reliably calculate the 95UCL, a minimum data set of at least 10 to 20 samples is needed (EPA 1992). Therefore, 15 percent of the groundwater samples (every seventh sample), or a minimum of 15 total, will be collected in duplicate and sent to a DHS-certified and NFESC-approved off-site laboratory for generation of definitive data. The duplicate samples will be shipped to the off-site laboratory and will be analyzed in accordance with the methods described in Section 2.4.2, "Off-Site Analyses." These same samples will also be used as confirmation for the on-site VOC and TEPH analyses.

At the conclusion of groundwater sampling, the on-site geologist and the field oversight task manager will review the site map with the posted contaminant concentrations. If the groundwater data indicate the location of a potential source(s) of the chlorinated VOC and TPH contamination, a geophysical survey using ground penetrating radar (GPR) will be performed at the suspected area(s). In addition,

subsurface soil samples will be collected at the suspected source location(s). Subsurface soil samples will be collected from up to 25 soil borings (the sampling locations will be determined by the on-site geologist based on the groundwater and GPR data) at depths of 1.0 foot bgs, 4.0 feet bgs, and 7.0 feet bgs. Soil samples will be shipped to a DHS-certified and NFESC-approved off-site laboratory and analyzed for VOCs, SVOCs, total metals, and TEPH as specified in Section 2.4.2.

To assess whether past hazardous waste storage activities at GAPs 9a and 9b have impacted the environment, a minimum of 3 surface soil samples must be collected (EPA 1986). Based on a site walk to be performed prior to sampling, the on-site geologist will use professional judgment to select 5 sampling locations at each GAP site based on field observations. Surface soil samples will be collected from areas where either soil staining is evident, or where the indication of runoff is observed. Soil samples will be shipped to a DHS-certified and NFESC-approved off-site laboratory and analyzed for VOCs, SVOCs, total metals, and TEPH as specified in Section 2.4.2.

## **2.5 GROUNDWATER MONITORING WELL PLACEMENT AND INSTALLATION**

Once the analytical results of the samples collected during this investigation are received, an in-depth evaluation of the data will be conducted. The evaluation will assess the need for the installation of additional monitoring wells at the site. Groundwater monitoring wells will be necessary to monitor the movement of the chlorinated VOC and TPH plume at discrete depths throughout the first, and possibly second, water-bearing zones. The placement of each monitoring well will depend on the results of the groundwater investigation. Additional groundwater monitoring wells will be installed near the downgradient edge of the plume at the particular depth of interest. By locating the groundwater monitoring wells at the downgradient edge of the plume, both the flow rate and concentration of the chemicals can be monitored. In addition, wells that are placed at the leading edge of the plume can assist in evaluating the efficiency of treating groundwater during remediation, if necessary.

Groundwater monitoring wells will be installed in accordance with TtEMI's standard operating procedure for monitoring well installation (Appendix C). Based on the known geology at Site 14, fine-grained fill material to 15 feet bgs and Bay sediments from 15 to 38 feet bgs, monitoring wells will be installed using a drill rig equipped with continuous-flight, hollow-stem augers. An 8-inch diameter soil boring will be drilled at each well location to the depth specified by the on-site geologist. A 2-inch

diameter groundwater monitoring well assembly will be installed in the center of each boring. Additional details on monitoring well installation are presented in Appendix C.

### **3.0 SITE 25 REMEDIAL INVESTIGATION**

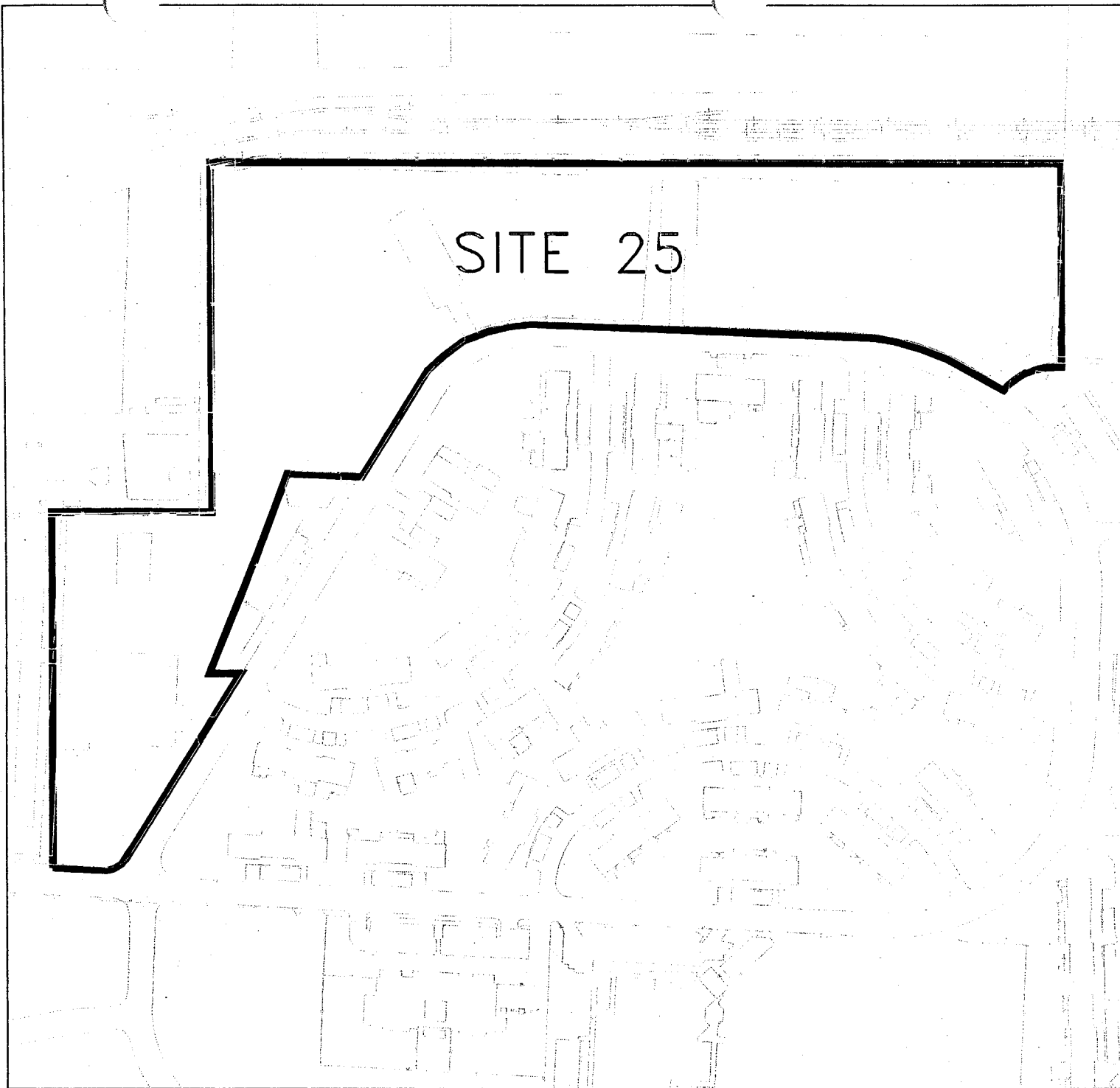
This section describes the history of this investigation and the DQOs and field sampling program necessary to evaluate whether the land area at Site 25 contains contaminated soil and groundwater that may impact human health and the environment.

#### **3.1 DESCRIPTION AND HISTORY**

Site 25, previously identified as EBS Parcel 182, is irregularly shaped and is located in the northeast corner of Alameda Point (Figure 8). Site 25 is bordered by residential areas to the south (EBS Parcels 181 and 183), railroad tracks and Fleet Industrial Supply Center Oakland Alameda Annex Facility (Alameda Annex) to the north and east, and Todd Shipyard to the west.

Until the 1920s, the general area of Site 25 existed as undeveloped marshlands and tidal flats along the San Francisco Bay fringe. The area south of Alameda Annex and Site 25 was the location of major industrial operations, including an oil refinery, an asphalt pipe manufacturing plant, a soap company, a carriage factory, and other manufacturing businesses (Willard 1988). Many of these facilities are believed to have stored and used hazardous materials as well as generated hazardous and toxic wastes during their daily operations and manufacturing processes (PRC 1996). These wastes may have been transported by ground surface runoff and deposited on the marshlands, particularly along the tidal channels. Between 1925 and 1927, the undeveloped marshlands and tidal channels underlying Site 25 (see Figure 8a) and the surrounding areas were filled with sand and clay material reportedly dredged from nearby historic tidal flats, the Oakland Inner Harbor, and San Francisco Bay. No information is available on the condition or operations of Site 25 between 1927 and 1947.

Barracks housing units existed on Site 25 from 1947 through at least 1966. Based on aerial photographs of Alameda Point, the housing barracks were demolished sometime between 1966 and 1970. One building (Building 534) currently exists at the site. Building 534 was most recently used by the Navy Public Works Center as a housing office (IT 1997). Alameda Point utility maps have shown that a concrete structure in northeast corner of Site 25 is the remains of a former sewage lift station. These



LEGEND

□ IR SITE BOUNDARY

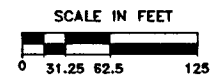
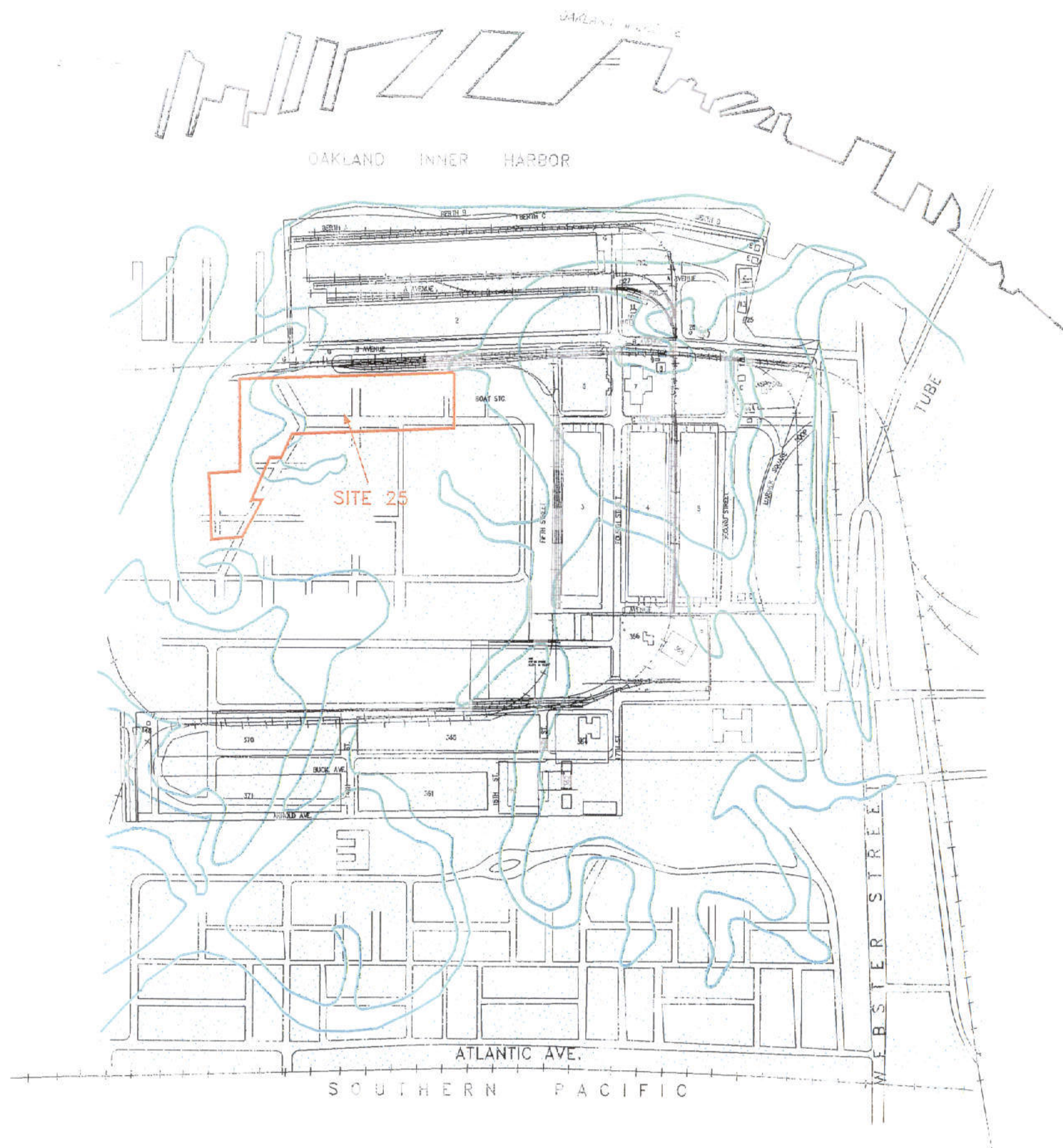





FIGURE 8

SITE 25  
BOUNDRY

ALAMEDA POINT  
ALAMEDA, CALIFORNIA



# LEGEND

-  HISTORIC CHANNEL LOCATIONS
-  FORMER MARSHLANDS
-  INSTALLATION RESTORATION (IR) SITE

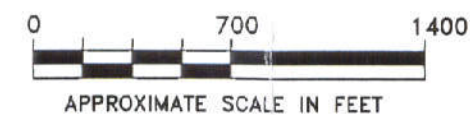


FIGURE 8a  
HISTORIC TIDAL CHANNEL MAP

FLEET AND INDUSTRIAL SUPPLY CENTER, OAKLAND  
ALAMEDA FACILITY/ALAMEDA ANNEX SITE



structures represent less than 5 percent of the Site 25 area. The remaining 95 percent of Site 25 is open space primarily covered in grass and used as a baseball field, picnic grounds, and sports courts.

The following environmental studies have been conducted at Site 25:

- In 1994 and 1995, the Navy conducted an EBS that included the collection of surface soil samples and soil gas samples at Site 25 (formerly EBS Parcel 182). The results of Phase 2A of the EBS are presented in the "Parcel Evaluation Data Summary Phase 2A Sampling, Zone 16: The Housing Zone (Parcel 182)" (IT 1997). Six surface soil samples and three soil gas samples were collected from three target areas at Site 25. Analytical results of the soil samples indicated elevated levels of SVOCs, specifically PAHs, TPH-motor oil, and detectable levels of methoxychlor (a diphenyl chloride insecticide). PCBs were not detected in soil samples. Metals were also detected at low concentrations in soil samples. VOCs were not detected in soil gas samples. Figures showing the results of Phase 2A of the EBS are presented in Attachment A.
- In 1995, the Navy conducted Phase 2B of the EBS that included the collection of surface and subsurface soil samples and groundwater samples at Site 25. The results of Phase 2B of the EBS are presented in the "Parcel Evaluation Data Summary Phase 2B Sampling, Zone 16: The Housing Zone (Parcel 182)" (IT 1997). Five subsurface soil samples, three surface soil samples, and four groundwater samples were collected from two target areas identified from the Phase 2A sampling evaluation. Elevated levels of SVOCs, specifically PAHs, were detected in soil samples to a depth of 8.0 feet bgs. TPH-gasoline and PAHs were detected at low levels in groundwater samples in the first water-bearing zone. Figures showing the results of Phase 2B of the EBS are presented in Attachment A.
- In 1998, the Navy conducted an additional investigation of Site 25 that included the collection of nine surface soil samples. The results of the 1998 investigation indicated that elevated levels of SVOCs, specifically PAHs, were detected in the soil samples to a depth of 1 foot bgs. In addition, the Navy collected four surface soil samples from a small playground area under construction at Site 25. These results indicated that elevated levels of SVOCs, specifically PAHs, were detected in the soil samples at a depth of 1 foot bgs.

Shallow groundwater to the southeast of Site 25 has been shown to be impacted by contamination from two Alameda Annex IR Sites (Sites 02 and 03) as described in the cumulative groundwater monitoring report (TiEMI 1998c):

- VOCs, SVOCs, TPH, and metals were detected in groundwater samples collected during nine sampling events from 1994 to 1996. Fuel-related VOCs (BTEX) were detected in more wells and at higher concentrations than other VOCs. Benzene was detected in 208 out of 356 samples at a maximum concentration of 1,400 µg/L. Chlorinated VOCs (chloroform, 1,1-dichloroethane, 1,2-dichloroethene, 1,1,2-trichloroethane, and vinyl chloride) were detected infrequently and at relatively low concentrations (1,1,2-trichloroethane was detected in two out of 356 samples with a maximum concentration for the chlorinated VOCs of 17 µg/L). SVOCs (mainly PAHs) were detected in a number of monitoring wells. Benzo(a)pyrene was

detected in 16 out of 356 samples with a maximum concentration of 9 µg/L; acenaphthylene was detected in 162 out of 356 samples with a maximum concentration for PAHs of 450 µg/L. TPH compounds were detected in most samples collected (gasoline was detected in 242 out of 356 samples with a maximum concentration for TPH of 8.1 µg/L). Various metals were detected in a number of wells at Alameda Annex; however, the maximum detected concentrations for most metals were similar to the maximum background concentrations for Alameda Point (see metals background comparison in Appendix B). Figures showing the groundwater elevation contours and the contaminant distribution for various chemicals at Alameda Annex are presented in Attachment B (TtEMI 1998c).

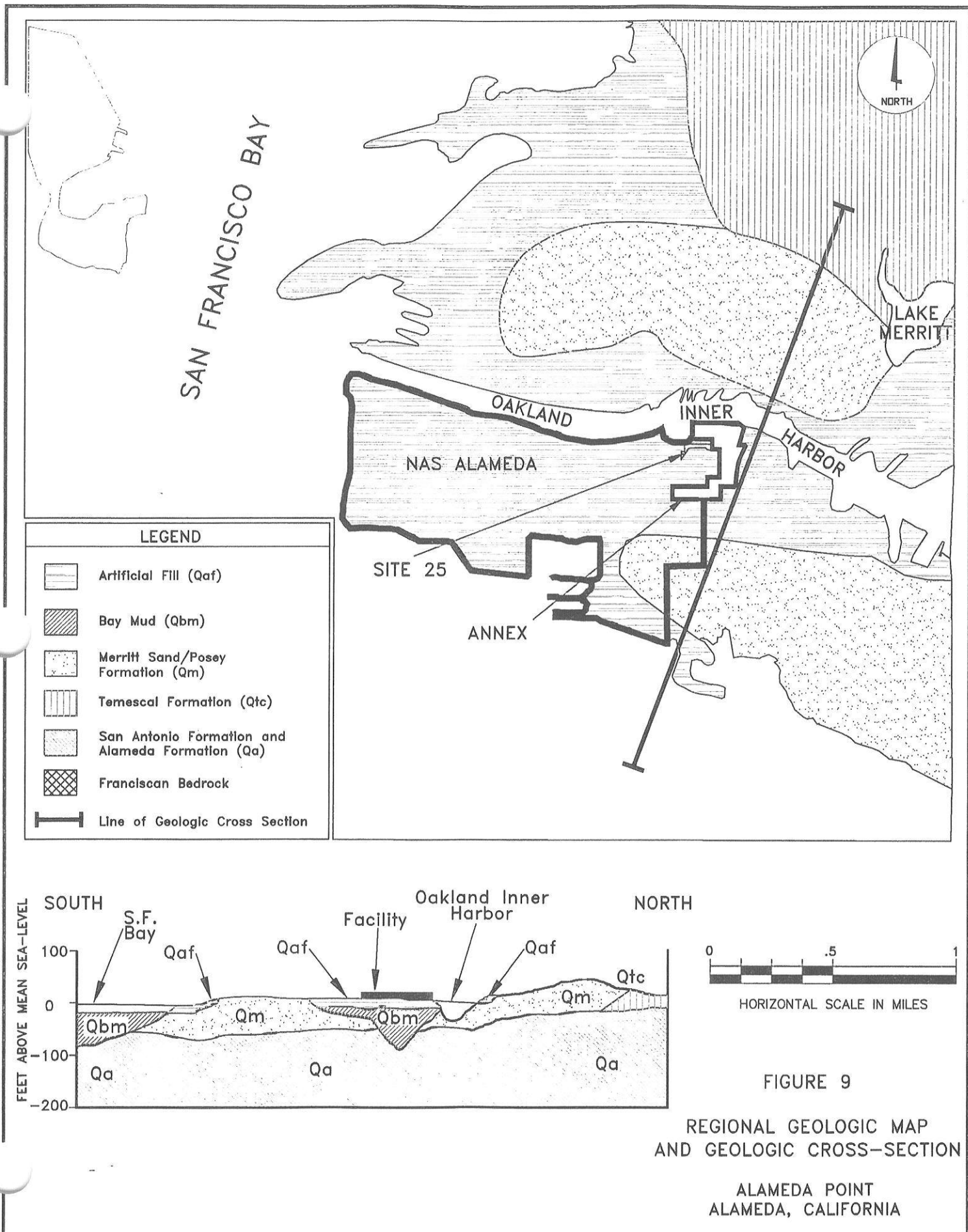
Based on the results of these investigations, elevated levels of PAHs and TPH (and potentially BTEX related to gasoline) in soil and groundwater exist at Site 25; however, no known sources of the contamination have been identified. This investigation will further identify and evaluate the nature and extent of these chemicals in soil and groundwater at Site 25.

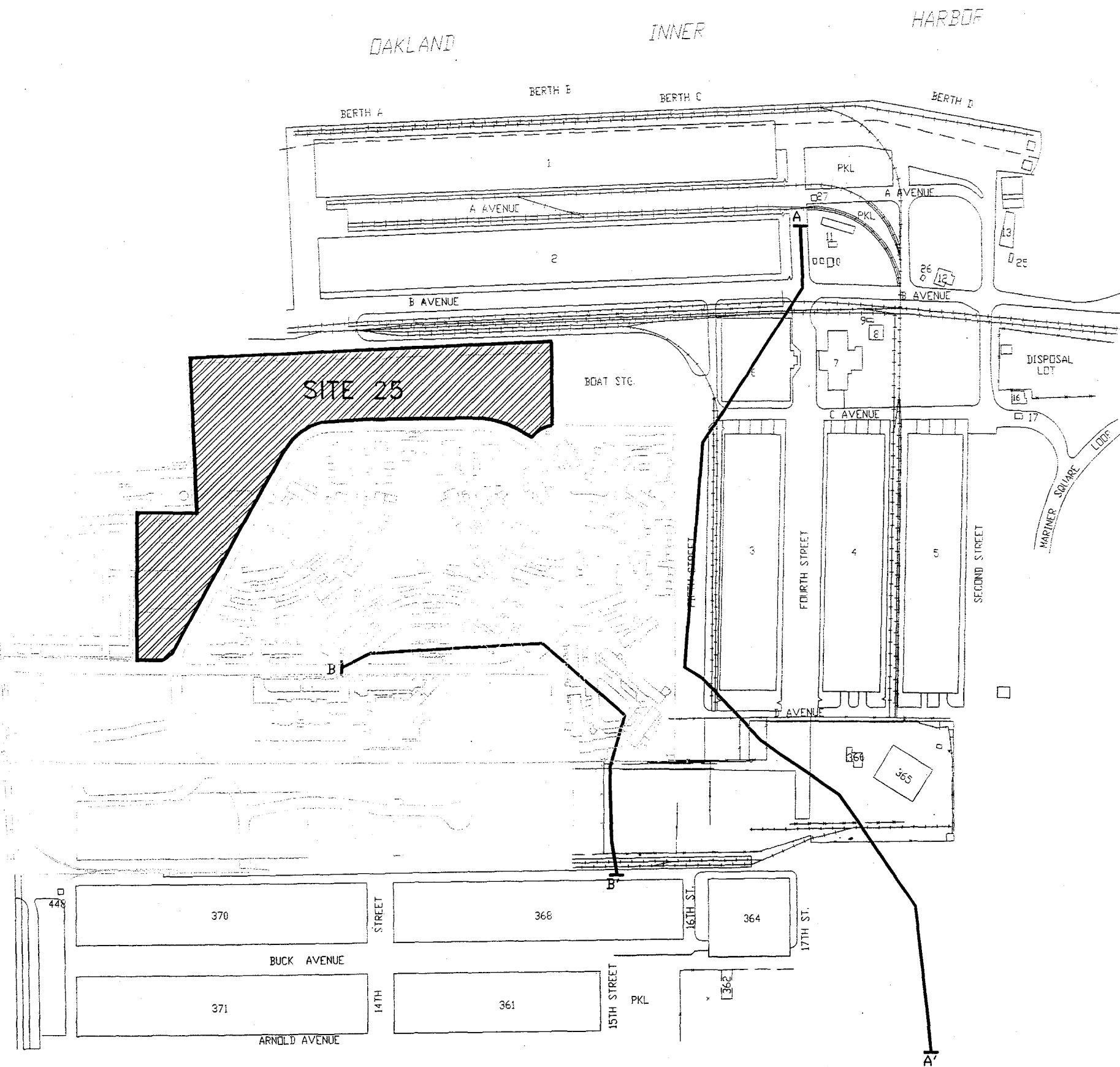
### **3.2 GEOLOGY AND HYDROGEOLOGY**

Site 25 consists of fill material to a depth of approximately 10 to 12 feet bgs. Fill material is present throughout Site 25 and overlies all other late Quaternary sediments. The fill contains various soil types, including sand, silt, and clay, as well as some debris. Groundwater beneath Site 25 occurs in the shallow fill material, which constitutes the first water-bearing zone, and in the deeper Merritt Sand Formation, which constitutes the second water-bearing zone. Between the first and second water-bearing zones lie the Bay Sediments. The lateral extent of the fill material, the Bay Sediments, the Merritt Sand Formation, and the hydrogeologic units at Site 25 are currently undefined. While geology specific to Site 25 is unavailable, the regional geologic map, the historic tidal channel map, and the cross-sections presented on Figures 9 through 12 are representative of the geology underlying Site 25. These figures are excerpted from the groundwater monitoring report for Alameda Annex (TtEMI 1998c).

Groundwater elevation data indicate that shallow groundwater generally flows to the north-northwest. Based on water levels measured from 1994 to 1996, the depth to groundwater in the fill material varies between approximately 2 and 12 feet bgs. Groundwater elevations ranged from -1.88 to 8.83 feet above mean sea level. Negative values of groundwater elevations occurred near Oakland Inner Harbor where groundwater may be affected by tides. The significant variations in groundwater elevations across Site 25 and surrounding areas may be explained in part by the heterogeneous nature of the fill (PRC 1996).







# LEGEND

C — C' CROSS SECTION LINE

 SITE BOUNDARY

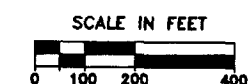
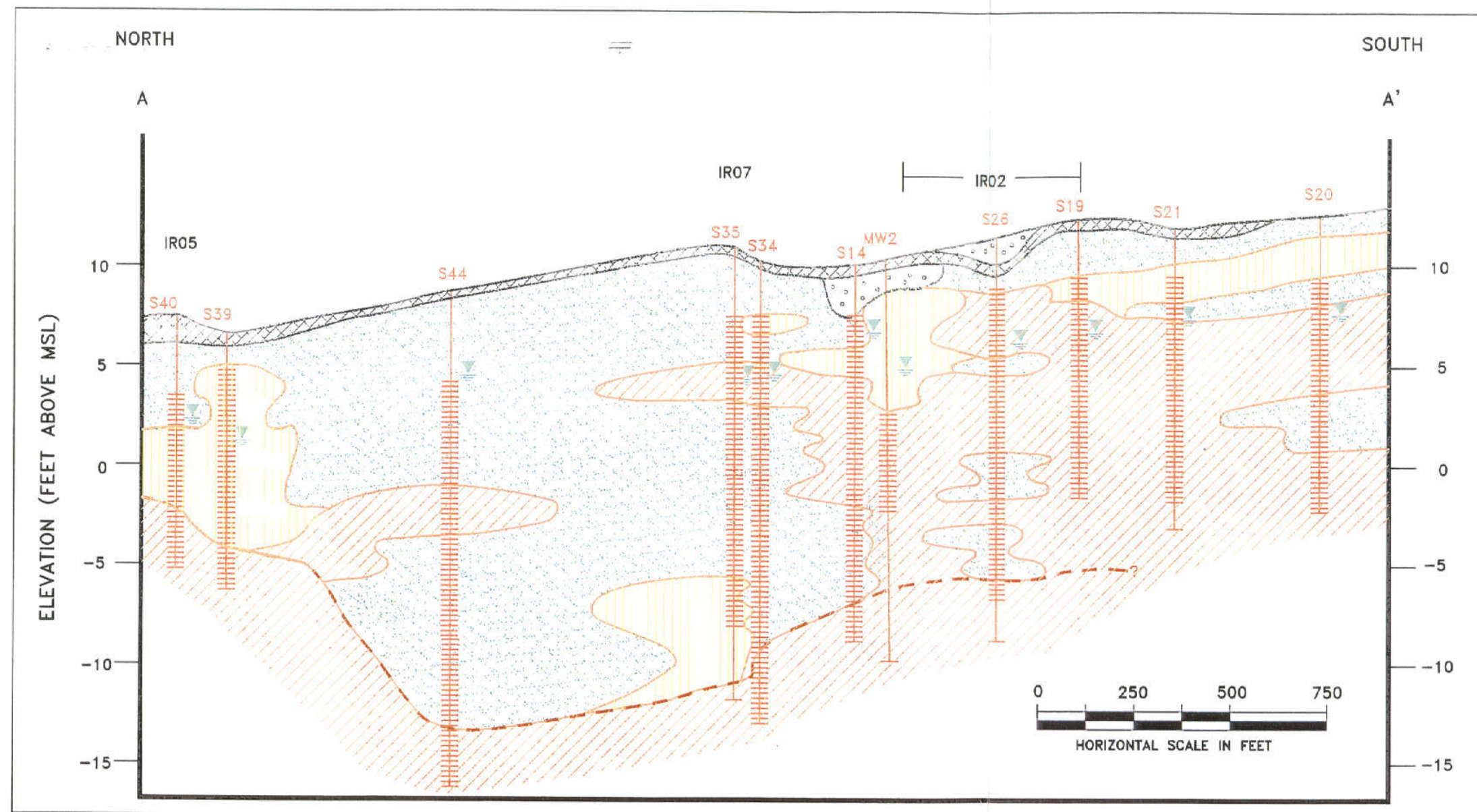










FIGURE 10  
CROSS-SECTIONS IN  
THE VICINITY OF SITE 25  
ALAMEDA POINT





# LEGEND

-  WELL WITH SCREEN INTERVAL
-  GROUNDWATER ELEVATION (OBSERVED ON 12/19/94)
-  SAND AND SILTY SAND
-  CLAYEY SAND AND SILT
-  CLAY AND SANDY CLAY
-  GRAVEL
-  ASPHALT
-  APPROXIMATE UPPER SURFACE OF BAY MUD

## CROSS-SECTION LOCATION

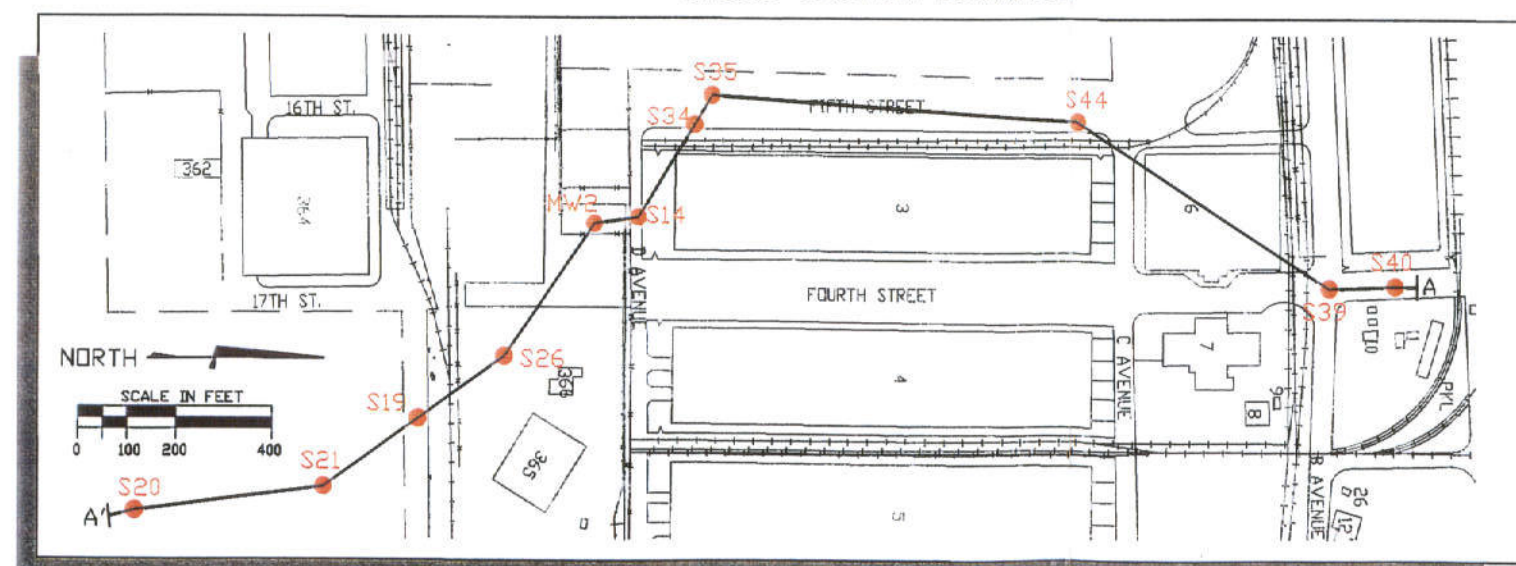
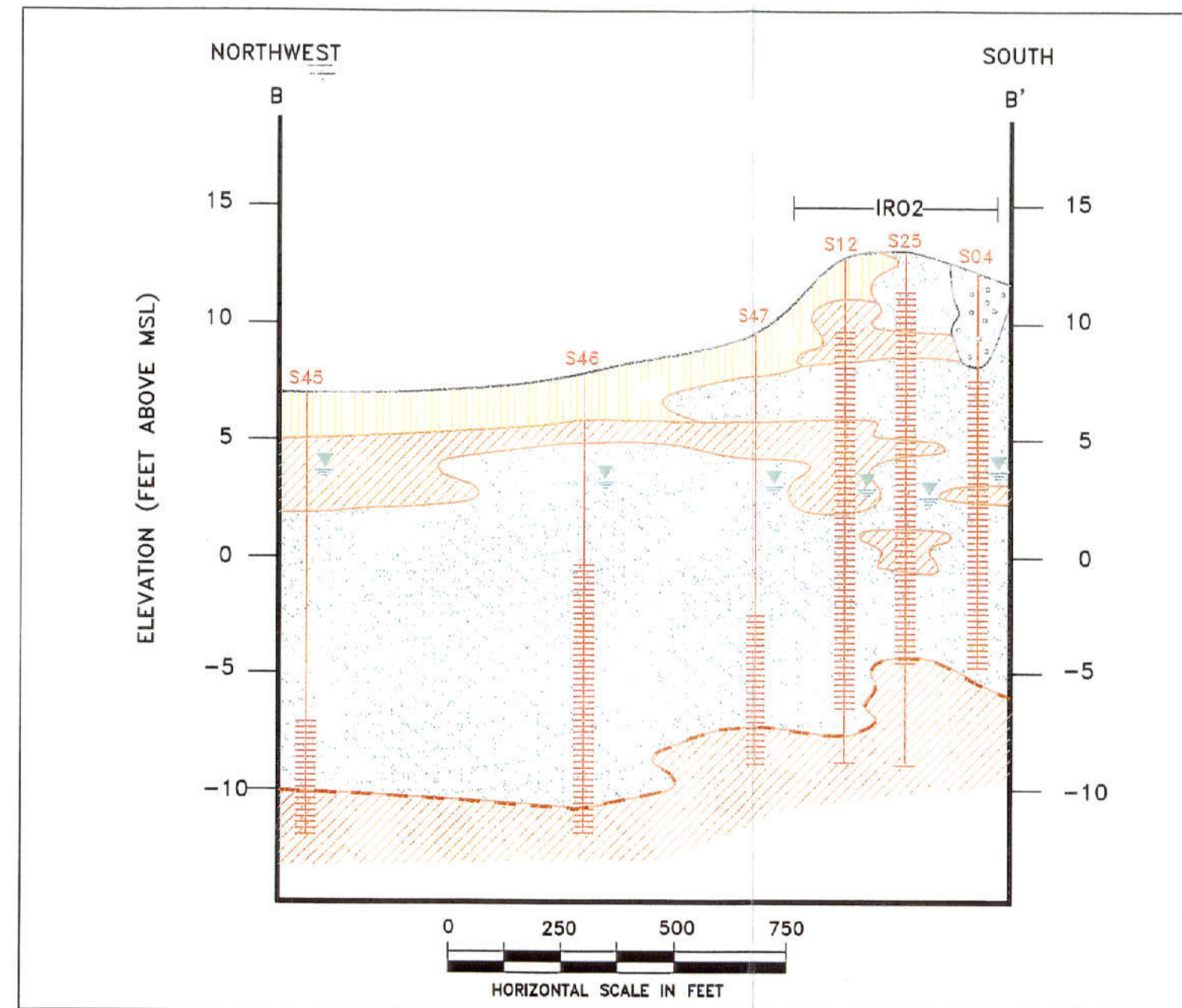


FIGURE 11









HYDROGEOLOGICAL  
CROSS-SECTION A - A'  
SITE 25

ALAMEDA POINT  
ALAMEDA, CALIFORNIA





## LEGEND

-  WELL WITH SCREEN INTERVAL
-  GROUNDWATER ELEVATION (OBSERVED ON 12/19/94)
-  APPROXIMATE UPPER SURFACE OF BAY MUD
-  ASPHALT
-  SAND AND SILTY SAND
-  CLAYEY SAND AND SILT
-  CLAY AND SANDY CLAY
-  GRAVEL

## CROSS-SECTION LOCATION

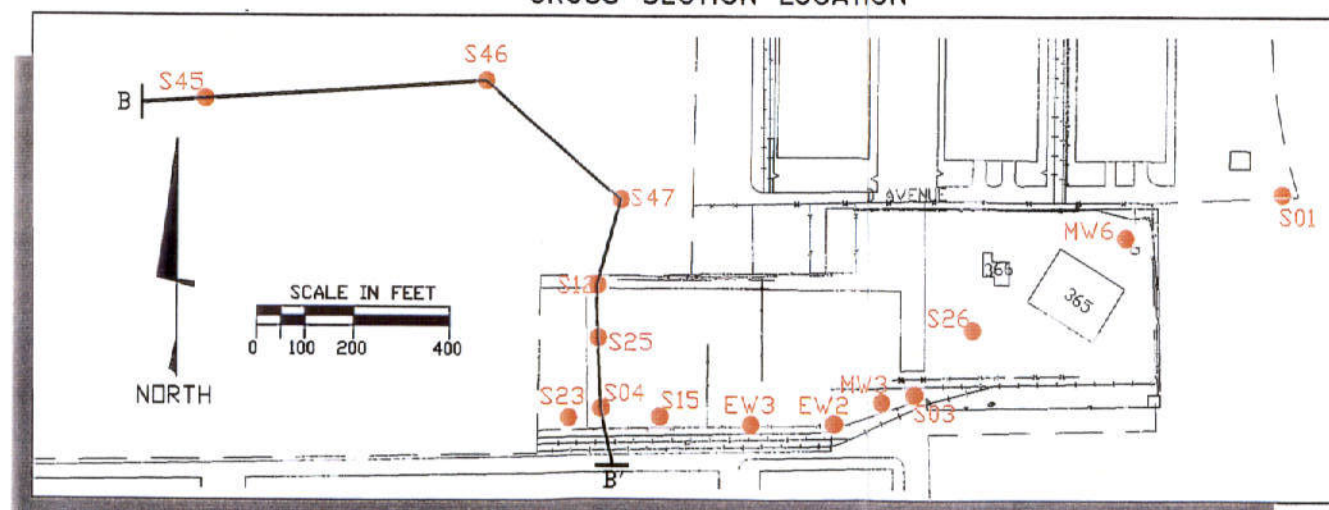


FIGURE 12

HYDROGEOLOGICAL  
CROSS-SECTION, B-B'  
SITE 25

ALAMEDA POINT  
ALAMEDA, CALIFORNIA

### **3.3 OBSERVED DISTRIBUTION OF CONTAMINATION**

Previous investigations at Site 25 have identified elevated levels of SVOCs, specifically PAHs, and TPH-motor oil in soil samples. Methoxychlor and some metals were also found at detectable levels in soil. TPH and PAHs (including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene) were detected from the surface to approximately 8 feet bgs in soil samples collected from the open field at Site 25. TPH-gasoline and PAHs were detected in groundwater samples collected from the first water-bearing zone near the north-central side of Site 25 (IT 1997). No PCBs were detected in soil or groundwater samples at Site 25.

Based on the soil and groundwater data presented above, TPH and PAHs are ubiquitous in the samples previously collected at Site 25; however, the contamination remains undefined throughout the site.

### **3.4 DATA QUALITY OBJECTIVES, ANALYTICAL PARAMETERS AND METHODS, AND SAMPLING DESIGN**

This section describes the DQOs, selection of analytical parameters and methods, and the sampling design and statistical methodology used in determining the quantity of samples necessary to meet the DQOs for the Site 25 RI.

#### **3.4.1 Data Quality Objectives**

The DQOs for Site 25 are identified as follows: (1) adequately characterize suspected chemical contamination at the site; (2) identify potential hot spots; and (3) perform an HHRA. To meet these DQOs, definitive data will be collected. The appropriate quantity of samples necessary to generate the required definitive data was determined using "Guidance for Data Usability in Risk Assessment, Part A" (EPA 1992). This guidance document provides the basis for planning the collection of environmental data for use in baseline risk assessments, provides statistical methods to calculate the number of samples needed to meet the DQOs, and discusses grid designs and sampling location determination.

### **3.4.2 Selection of Analytical Parameters and Methods**

Based on previous investigations at Site 25, soil and groundwater samples will be analyzed for PAHs, TEPH, TPPH, and BTEX. Although VOCs were not detected at Site 25, TPH-gasoline was detected in the area of the railroad tracks; therefore, soil samples will be analyzed for TPPH and BTEX. As determined during the EBS investigation (IT 1997), the detected metals concentrations at Site 25 were within typical background levels at Alameda Point or less than the EPA Region 9 preliminary remediation goals (PRG) (EPA 1998); therefore metals analyses will not be performed. PCBs were not detected in previous investigations at Site 25; therefore, PCB analyses will not be performed. Methoxychlor was the only organochlorine pesticide detected in the soil samples collected from Site 25; however, it was detected below its PRG. The maximum concentration of methoxychlor detected in soil was 0.22 mg/kg; its corresponding residential soil PRG is 270 mg/kg (EPA 1998). Therefore, organochlorine pesticide analyses will not be performed.

Samples collected during the Site 25 RI will be analyzed by a DHS-certified and NFESC approved off-site laboratory for generation of definitive data. Each sample collected will be analyzed by the off-site laboratory for (1) PAHs in accordance with the CLP SOW OLM03.1 (EPA 1994); (2) TEPH in accordance with SW-846 Method 8015M, (3) TPPH in accordance with SW-846 Method 8015M; and BTEX in accordance with SW-846 Method 8020 (EPA 1986). In addition, because the CLP soil reporting limits for several PAHs are higher than their respective residential PRGs, soil samples reported as non-detected for benzo(a)pyrene and/or dibenz(ah)anthracene (which have the highest carcinogenic potentials and the lowest residential PRGs of the PAHs) will be reanalyzed using SW-846 Method 8310 (EPA 1986). SW-846 method 8310 will provide detection limits below the PRGs for all PAHs. The off-site laboratory will also perform all methods and procedures in accordance with TtEMI's Laboratory Services SOW (PRC 1995a). Detailed descriptions of off-site laboratory procedures, analytical methodologies, and a sample identification table for Site 25 are provided in the QAPP (Appendix A).

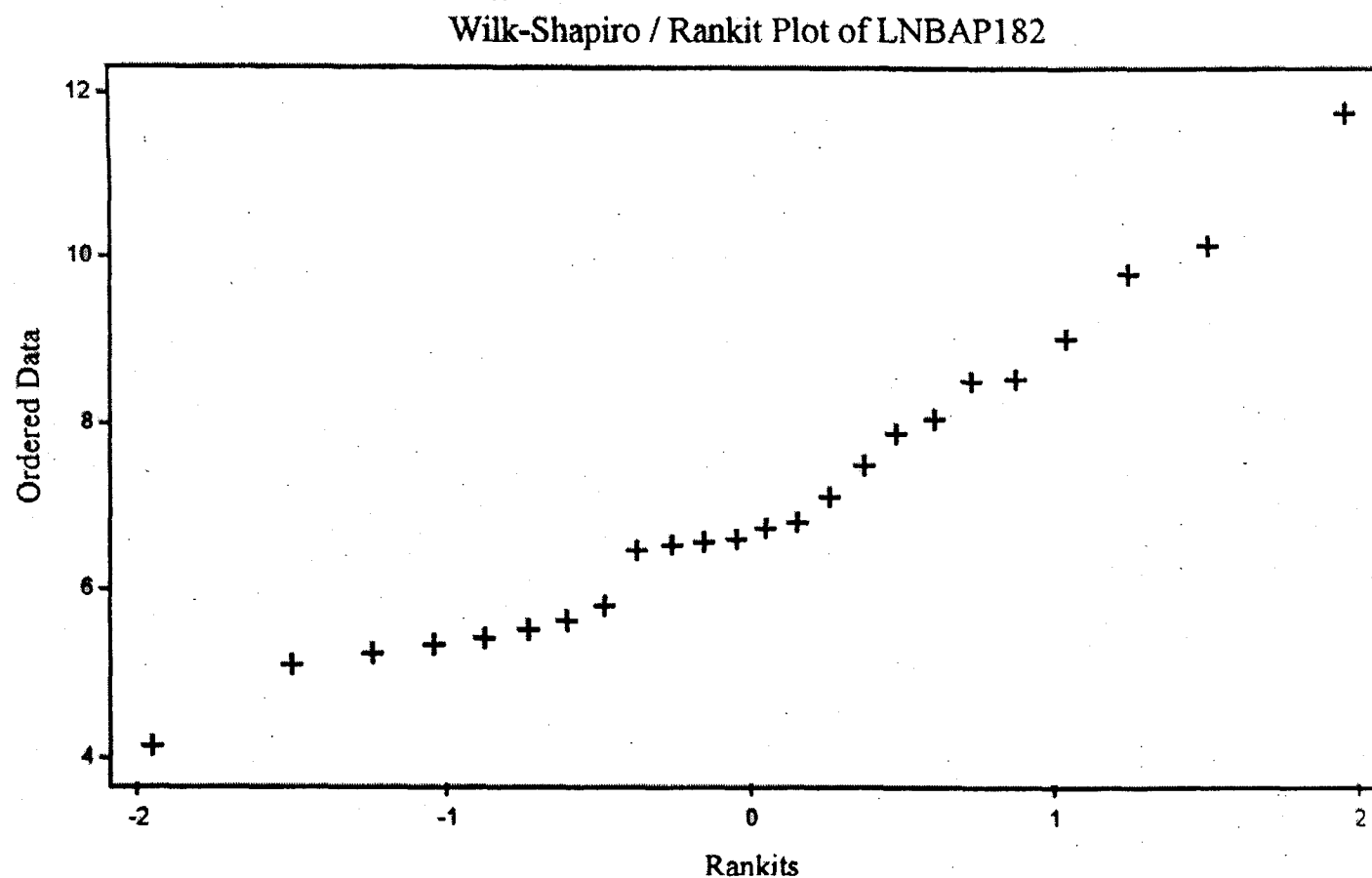
### **3.4.3 Sampling Design**

To evaluate trends and to identify previously undetected hot spots at Site 25, a systemic sampling grid design was selected. This sampling design will also provide unbiased estimates of chemical occurrence and concentrations that will be useful in calculating the exposure concentration for risk assessment purposes (EPA 1992).

To estimate the number of samples needed, the coefficient of variation (CV), power, level of confidence, and minimum detectable relative difference (MDRD) were first determined. Because benzo(a)pyrene has a high carcinogenic potential (relative to other chemicals detected at the site), has a low potential for biodegradation, and has a low residential PRG in soil (EPA 1998), benzo(a)pyrene was selected as the indicator chemical for the site. The CV for benzo(a)pyrene at Site 25 was determined from previously collected data, which are summarized in Table 2. Benzo(a)pyrene was determined to be lognormally distributed (Figure 13) at the site, and the summary statistics presented are based on logarithmically transformed data. The CV was determined to be 26 percent. The desired power was set at 90 percent, and the level of confidence at 95 percent (which exceed the minimum EPA recommendations of 80 percent and 90 percent for power and level of confidence, respectively [EPA 1992]).

The MDRD is the percent difference required between site and background concentrations before the difference can be statistically detected. For the purposes of benzo(a)pyrene, the comparison level was assumed to be the EPA Region 9 residential PRG of 0.056 milligram per kilogram (mg/kg). An MDRD of 10 percent was selected, which would mean that the data set would be sufficient to detect a difference of 10 percent between the PRG and background concentrations (for example, the difference between 0.056 mg/kg and 0.050 mg/kg). Based on the assumptions stated above, the table provided in Appendix IV of the guidance document was used to determine that a minimum of 70 soil samples would be needed to meet the DQOs (EPA 1992).

To locate previously unidentified hot-spots at Site 25, 70 soil samples will be collected at depths of 1 foot and 7 feet bgs from 35 locations spaced over the site. To determine the possibility that the contaminants were deposited at Site 25 anthropogenically, sampling locations were chosen such that seventeen of the sampling locations will be collected from areas where former housing barracks or concrete/asphalt parking pads were located. The remaining 18 sampling locations are located in areas known not to have been occupied by buildings or concrete parking pads (see Figure 14). Soil samples will be identified by boring number and depth. For example, the soil boring identification 23-7.0 would indicate that the sample was collected from boring location 23 at a depth of 7 feet bgs. Sampling locations and depths for Site 25 are listed in Table 3. Based on a statistical hot-spot analysis of the soil sampling results, any hot-spots identified at Site 25 will be further investigated through the collection of additional soil samples (an addendum to this FSP will be prepared for any additional field work proposed).



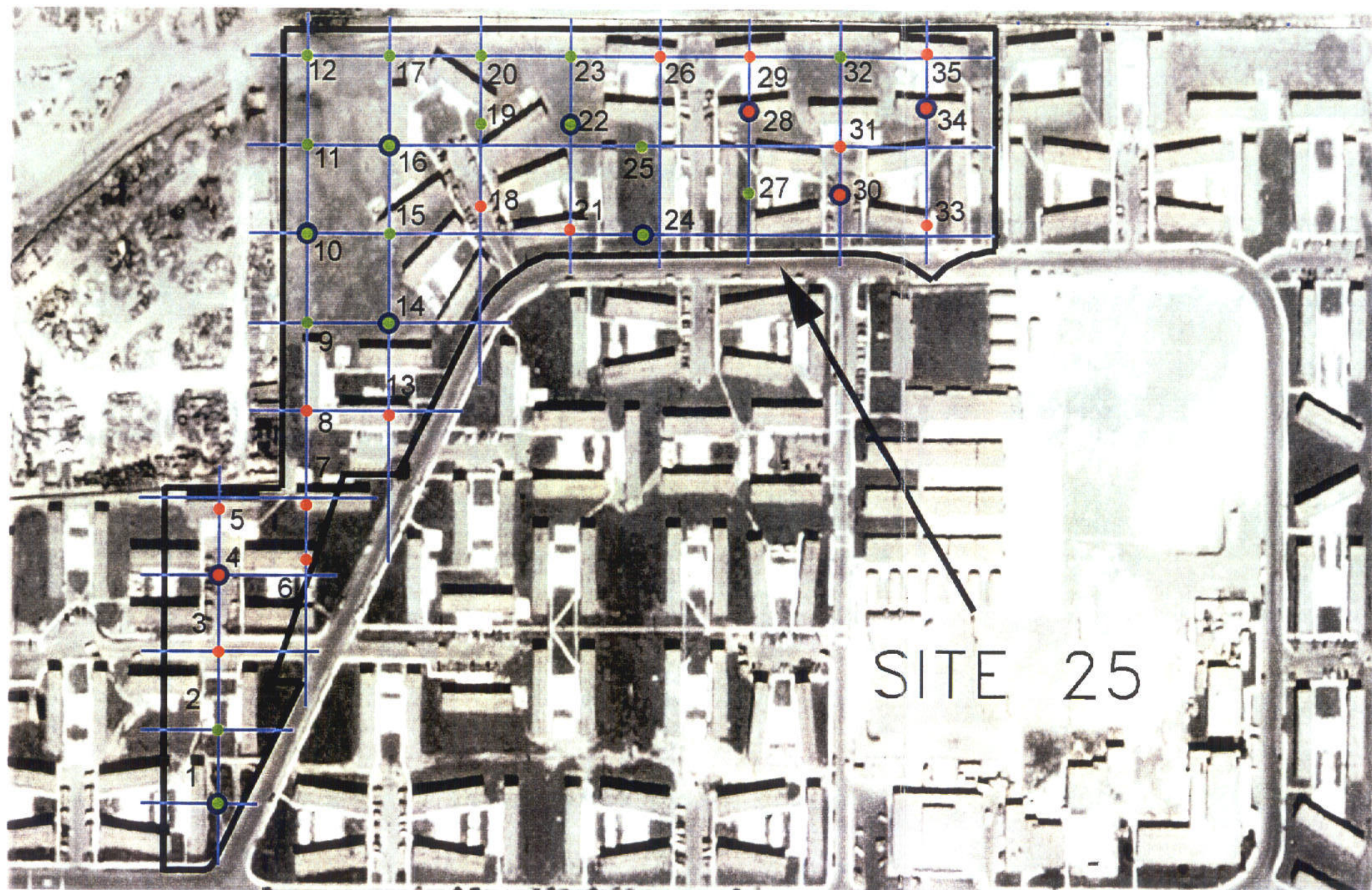
Approximate Wilk-Shapiro 0.9487 24 cases

FIGURE 13

LOGNORMAL DISTRIBUTION OF  
BENZO(A)PYRENE, SITE 25

ALAMEDA POINT  
ALAMEDA, CALIFORNIA





# LEGEND

- IR SITE BOUNDARY
- 1-FOOT AND 7-FOOT SAMPLING LOCATIONS FROM GRASS AREAS
- 1-FOOT AND 7-FOOT SAMPLING LOCATIONS FROM UNDER FORMER BUILDING FOUNDATIONS, CONCRETE, OR ASPHALT
- 4-FOOT AND 10-FOOT SAMPLING LOCATIONS

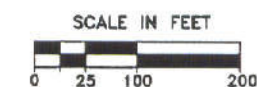


FIGURE 14  
 SAMPLING GRID  
 SITE 25  
 ALAMEDA POINT  
 ALAMEDA, CALIFORNIA



**TABLE 2**

**STATISTICAL ANALYSIS OF DATA FOR BENZO(A)PYRENE  
SITE 25  
ALAMEDA POINT**

<b>Chemical</b>	<b>Frequency of Detection</b>	<b>Sample Quantitation Limits (<math>\mu\text{g/kg}</math>)</b>	<b>Range of Detected Values (<math>\mu\text{g/kg}</math>)</b>	<b>Mean (<math>\mu\text{g/kg}</math>)</b>	<b>Variance (<math>\mu\text{g/kg}</math>)</b>	<b>Coefficient of Variation Percent</b>
Benzo(a)pyrene	14/16	390-430	63-130,000	1247.4	30.2	25.9

Note:

$\mu\text{g/kg}$  = micrograms per kilogram

**TABLE 3**  
**SOIL SAMPLING LOCATIONS AND DEPTHS**  
**SITE 25**  
**ALAMEDA POINT**

Boring Number	Sample Depth (feet)			
	1	4	7	10
1	X	X	X	X
2	X		X	
3	X		X	
4	X	X	X	X
5	X		X	
6	X		X	
7	X		X	
8	X		X	
9	X		X	
10	X	X	X	X
11	X		X	
12	X		X	
13	X		X	
14	X	X	X	X
15	X		X	
16	X	X	X	X
17	X		X	
18	X		X	
19	X		X	
20	X		X	
21	X		X	
22	X	X	X	X
23	X		X	
24	X	X	X	X
25	X		X	
26	X		X	
27	X		X	
28	X	X	X	X
29	X		X	
30	X	X	X	X
31	X		X	
32	X		X	
33	X		X	
34	X	X	X	X
35	X		X	

To support the characterization of Site 25, additional subsurface samples will be collected at 10 of the sampling locations at depths of 4 and 10 feet bgs. The selection of these sampling depths is based on extrapolated geologic data collected during previous investigations performed near Site 25 (TtEMI 1998c). Sampling depths may be adjusted based on actual geologic conditions determined during sampling. To represent all areas of the site, the 10 subsurface sampling locations are spaced as evenly as possible over the site. Continuous core samples will be collected at these sampling locations and logged for lithology. Samples will be cut from the cores after the core logging is complete. Figure 14 shows the sampling grid and identifies the locations where the additional subsurface soil samples will be collected. Sampling locations and depths for Site 25 are listed in Table 3.

To support the HHRA for Site 25, surface soil samples, as described above, and groundwater samples will be collected and evaluated. The soil and groundwater data will be used to calculate the 95UCL concentrations. Currently, no monitoring wells exist at Site 25 and minimal groundwater samples have been collected. In order to reliably calculate the 95UCL, a data set of at least 10 to 20 samples is needed (EPA 1992). Therefore, groundwater samples will be collected adjacent (within 3 feet) to the locations where the 10 additional subsurface soil samples will be collected.

#### 4.0 SAMPLE COLLECTION

Groundwater samples for Site 14 will be collected at discrete depths (as described in Section 2.4.3) using a direct-push probe with a screen-point (slotted) sampling tip (Figure 15). The direct-push probe consists of 3-foot sections of 2-inch-diameter hollow tubular steel rods connected by threads. The tip section contains a smaller diameter section of rod that is slotted to allow water to enter. During advancement, the slotted sampling tip is held up into the tip section of the rod using a pointed metal drive tip. The probe is advanced through the soil using hydraulic, vibratory, or hammer force. As the probe is advanced, additional sections of rod are screwed into place so that the desired sampling depth can be reached. Once the desired depth is reached, the probe is extracted approximately 18 inches allowing exposure of the slotted sampling tip. A small diameter well bailer is then dropped through the hollow rods and a water sample collected.

Once the sample is collected, the rods are extracted from the soil, decontaminated, and re-fitted with a clean, slotted sampling tip. The sampling probe is then readvanced through the soil to collect the next sample. If hydrogeologic conditions are such that the permeability of the aquifer is insufficient to

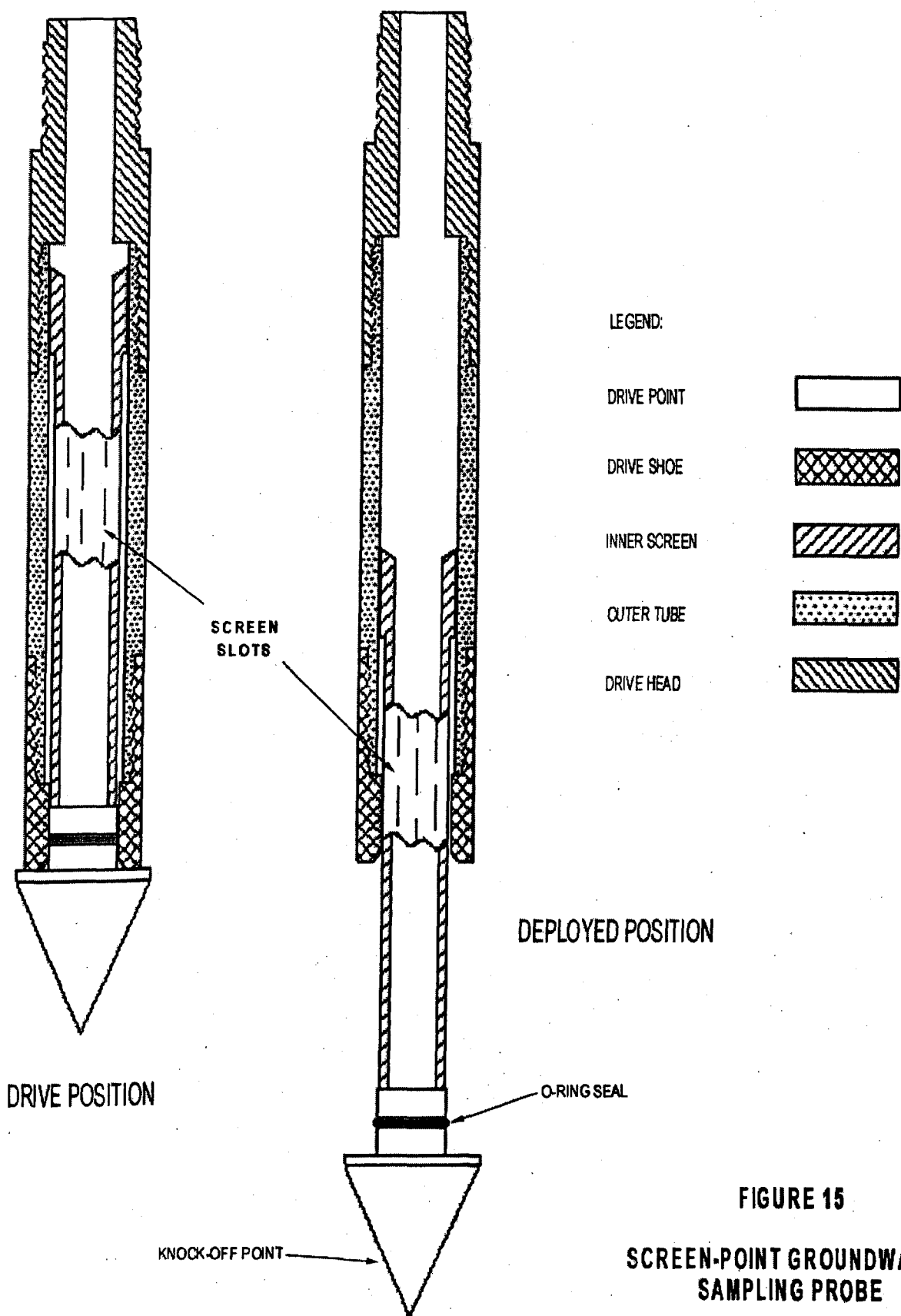


FIGURE 15  
SCREEN-POINT GROUNDWATER  
SAMPLING PROBE  
ALAMEDA POINT  
ALAMEDA, CALIFORNIA

produce the required amount of groundwater to collect a sample, a temporary piezometer will be installed. The groundwater sample will then be collected at a later time.

Soil cores and samples collected at both sites will be collected using the Enviro-Core® continuous sampling system; a dual tube, direct-push soil coring device (Figure 16). The Enviro-Core® system consists of small diameter outer drive casing and an inner sample barrel that are simultaneously advanced into the ground using either hydraulic, vibratory, or hammer force. The drive casing has an outer diameter (OD) of 2.4 inches and is machined into 3-foot-long, threaded sections. A heat-treated steel drive shoe is threaded onto the bottom piece of drive casing, and a steel drive head is threaded onto the top section of casing. The sample barrel is made of a 3-foot-long section of 1.8 inch OD, thin-walled steel tubing. The sample barrel has an OD slightly smaller than the inside diameter of the outer drive casing, allowing it to be raised and lowered freely inside the outer drive casing. The sample barrel is held into the drive shoe using 3-foot sections of small diameter, threaded internal rods.

The sample barrel contains brass sleeves that "collect" the continuous soil core as the unit is advanced through the soil. After being advanced 3 feet, the inner barrel is retrieved, while the outer drive casing is left in place to prevent the borehole from collapsing. The outer drive casing ensures that subsequent soil samples are collected from the targeted interval, rather than potentially contaminated slough from higher up in the borehole. The stainless steel sleeves containing the soil cores are removed from the inside of the inner barrel. The sample sleeves are handled as specified in Appendix A.

Some sample sediment matrices have a tendency to slough out of the sample barrel upon retrieval from the outer drive casing. In this case, a synthetic sample catcher will be attached to the bottom of the inner barrel to prevent loose sediments from falling out of the sample sleeves when the inner barrel is retrieved.

Groundwater samples for Site 25 will be collected using the same equipment as described above for Site 14 with the exception that the water samples will be collected using a low-flow sampling pump. This method is preferred for VOC sampling and will reduce volatilization during collection of the BTEX samples. If the recharge rate of the groundwater at a chosen sampling location is not adequate to support the low-flow sampling method, the water sample will be collected using a small diameter well bailer. The groundwater interface at each sampling location will be determined based on the lithologic data collected during the logging of the adjacent soil cores. To maximize the potential to identify the highest concentrations of petroleum related chemicals (compounds that have relative densities less than 1.0) in

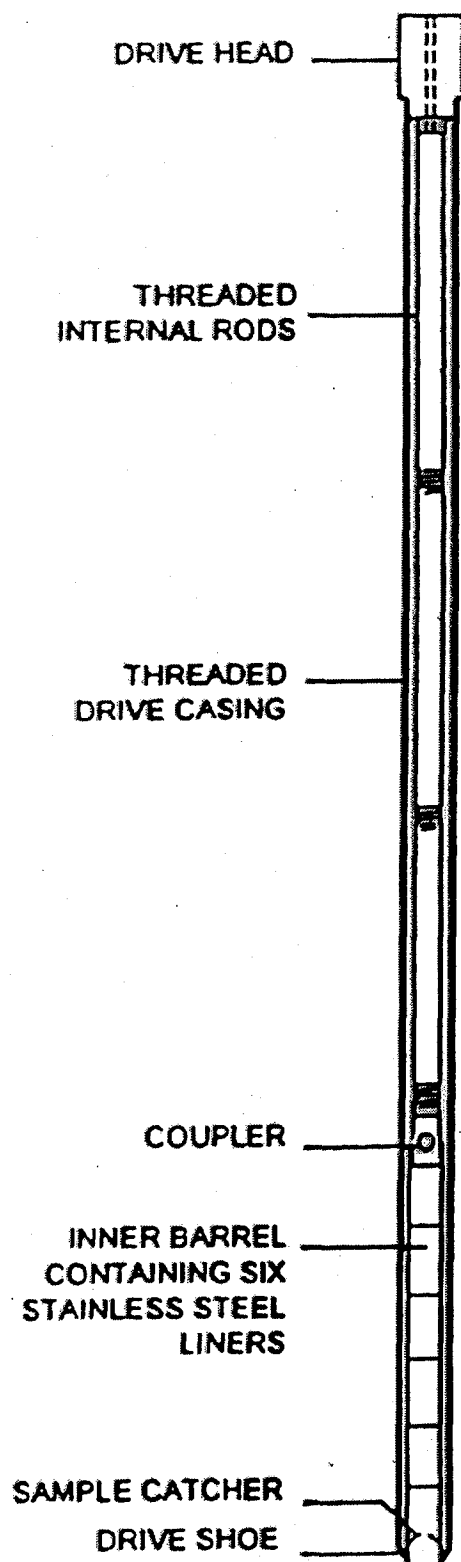


FIGURE 16  
ENVIRO-CORE® DIRECT  
PUSH SAMPLING PROBE

ALAMEDA POINT  
ALAMEDA, CALIFORNIA

the groundwater, groundwater samples for Site 25 will be collected at the groundwater interface determined for each sampling location.

## **5.0 HEALTH AND SAFETY**

Field work will be conducted in accordance with TtEMI's Health and Safety Program (PRC 1995b) and with the Alameda Point Base-wide Health and Safety Plan (TtEMI 1998d). A health and safety plan for the Alameda Point groundwater investigation and soil investigation will be provided by the subcontractor. The plan will conform to the requirements of (1) Title 29 of the Code of Federal Regulations 1910.120 (b) (4); (2) the U.S. Army Corps of Engineers (USACE) Engineer Manual (EM 385-1-1), Safety and Health Requirements, (USACE 1996); and (3) Navy Health and Safety Plan Review guidance (Navy 1996).

Prior to investigation activities, a job hazard analysis will be performed for each phase of field work. In addition, underground utilities, including electrical, sewer, and water lines, and any other buried features that may affect drilling, will be identified.

At each soil and groundwater sampling location, a photoionization detector (PID) will be used to determine petroleum hydrocarbon vapor concentrations at the surface of the borehole. Personal protective equipment upgrades and/or stop-work conditions are defined in the Alameda Point Base-wide Health and Safety Plan (TtEMI 1998d). The PID meter will be operated in accordance with the manufactures operating instructions.

## **6.0 SURVEYING**

Following the closure of the soil borings at Sites 14 and 25, a State of California-licensed, professional land surveyor will provide the elevation and coordinates of each soil boring. The elevations will be surveyed relative to the 1929 U.S. Geological Survey Mean Lowest Low Water (MLLW) datum. To remain consistent with standard survey practices used at Alameda Point, a baseline of 100 feet will be added to the MLLW datum to remove the possibility of negative elevations. The soil borings will be surveyed using the State Plane Coordinate System.



## **7.0 INVESTIGATION-DERIVED WASTE**

Three drums of soil cuttings and six drums of decontamination water are estimated to be generated during these field activities. All investigation-derived waste (IDW) will be handled and disposed of in accordance with TtEMI's IDW management plan (PRC 1994). The IDW will be placed in Department of Transportation 17H 55-gallon drums and the drums stored in a dedicated storage facility at Alameda Point for the duration of the project (approximately three to four weeks). Prior to disposal, the waste soil and water will be fully characterized for chemical contaminants. After characterization, the IDW will be sent to appropriate landfills or treatment facilities for disposal. IDW will be disposed of within 90 days of generation.

## REFERENCES

- California State Water Resources Control Board. 1988. "Leaking Underground Fuel Tank (LUFT) Field Manual." Prepared by the State of California LUFT Task Force. May.
- Ecology and Environment, Inc. 1983. "Initial Assessment Study, NAS Alameda, California." April.
- IT Corporation. 1997. "Parcel Evaluation Data Summary Phase 2A and 2B Sampling; Zone 16: The Housing Zone, Parcel Report for Parcel 182, NAS Alameda." November.
- IT Corporation. 1998. "Parcel Evaluation Data Summary Phase 2A and 2B Sampling; Zone 3: The Northwestern Construction and Maintenance Zone, Parcel Report for Parcel 17, NAS Alameda." Revision B. January.
- Perry. 1991. Personal Communication from Fire Chief Perry, NAS Alameda, Alameda, California. To Rich Halket of James M. Montgomery Consulting Engineers, Inc. (JMM).
- PRC Environmental Management, Inc. (PRC). 1994. CLEAN Program Waste Management Plan for Investigation-Derived Waste, Revision 0. January 31.
- PRC. 1995a. "Navy CLEAN II Laboratory Services Statement of Work (SOW)." June.
- PRC. 1995b. "Navy CLEAN II Health and Safety Plan." June.
- PRC. 1996. "Final RI Report, FISCO Alameda Facility/Alameda Annex Site, Alameda, California." January 31.
- PRC and JMM. 1992a "Data Summary Report RI/FS Phases 2B and 3, Final, NAS Alameda, Alameda, California." October 27.
- PRC and JMM. 1992b. "Data Summary Report for Background and Tidal Influence Studies and Additional Work at Sites 4 and 5, Draft Final, NAS Alameda, Alameda, California." August 4.
- PRC and Montgomery Watson [MW]. 1993. "Solid Waste Water Quality Assessment Test and Data Summary Report for RI/FS Phases 5 and 6, Final, NAS Alameda, Alameda, California." April 30.
- PRC and MW. 1996a. "RI/FS Data Transmittal Memorandum Sites 4, 5, 8, 10A, 12, 14, Final." April.
- PRC and MW. 1996b. "RI/FS Data Transmittal Memorandum Sites 1, 2, 3, Runway Area, 6, 7A, 7B, 7C, 9, 10B, 11, 13, 15, 16, and 19, Final." Volume I of II. May.
- Tetra Tech EM Inc. (TtEMI). 1998a. "Data Transmittal Memorandum for Sites 4 and 5 Chlorinated Solvent Plume Definition and Site 14 Sump Investigation, Alameda Point, Alameda, California." June.
- TtEMI. 1998b. "Data Summary Report for Quarterly Groundwater Monitoring, November 1997 through August 1998, Alameda Point, Alameda, California." August.

## REFERENCES (continued)

- TtEMI. 1998c. "Cumulative Groundwater Monitoring Report 1994 to 1996, Fleet and Industrial Supply Center, Oakland Alameda Facility/Alameda Annex, Alameda, California, Draft-Final." June 26.
- TtEMI. 1998d. "Base-wide Health and Safety Plan, Alameda Point, Alameda, California, Final." July.
- U.S. Environmental Protection Agency (EPA). 1986. "Test Methods for Evaluating Solid Waste." office of Solid Waste and Emergency Response." SW-846 Third Edition, including all promulgated updates. November.
- EPA. 1992. "Guidance for Data Usability in Risk Assessment (Part A)." EPA9285.7-09A. Office of Emergency and Remedial Response. Washington, D.C. April.
- EPA. 1994. "Contract Laboratory Program (CLP) SOW for Organic Analysis, Multi-Media, Multi-Concentration." Document Number OLM03.1. August
- EPA. 1995. "CLP SOW for Inorganic Analysis, Multi-Media, Multi-Concentration." Document Number ILM04.0.
- EPA. 1998. Letter-memo containing U.S. EPA Region IX Preliminary Remediation Goals (PRG). From Stanford J. Smucker, Ph.D., to PRG Table Mailing List. U.S. EPA Region IX. March.
- U.S. Army Corps of Engineers. 1996. "Engineer Manual, Safety and Health Requirements." Document Number EM 385-1-1. September 3.
- U.S. Department of the Navy (Navy). 1996. "Navy Health and Safety Plan Review Guidance." Navy Environmental Health Center, Environmental Programs Directorate. February.
- Navy. 1998. Project Scoping Meeting to Discuss Implementation of the Remedial Investigation for Sites 14 And 25 at Alameda Point. Attended by Representatives from the Navy, Department of Toxic Substances Control, EPA, and TtEMI. August 3.
- Willard, R. 1988. *Alameda County, California Crossroads*. Windsor Publications Inc.

**APPENDIX A**

**QUALITY ASSURANCE PROJECT PLAN**

**COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN II)**

**Northern and Central California, Nevada, and Utah**

**Contract No. N62474-94-D-7609**

**Contract Task Order No. 122**

**Navy Remedial Project Manager: Patricia McFadden**

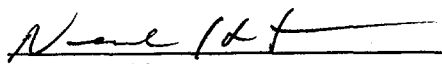
**TtEMI Project Manager: Neal Hutchison**

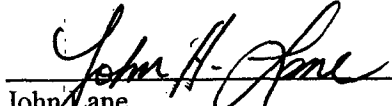
**ALAMEDA POINT  
ALAMEDA, CALIFORNIA**


**SITE 14 GROUNDWATER INVESTIGATION  
AND SITE 25 REMEDIAL INVESTIGATION  
QUALITY ASSURANCE PROJECT PLAN**

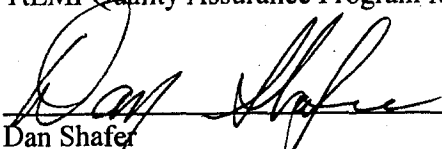
**REVIEWS AND APPROVALS**

Prepared by:

 Date: 10/12/98  
Neal Hutchison  
TtEMI Project Manager

 Date: 10/12/98  
John Lane  
TtEMI Project Chemist

 Date: 10/12/98  
Ron Riesing  
TtEMI Quality Assurance Program Manager

 Date: 10/12/98  
Dan Shafer  
TtEMI CLEAN Installation Coordinator

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## ABBREVIATIONS AND ACRONYMS

CLEAN	Comprehensive Long-term Environmental Action Navy
CLP	Contract Laboratory Program
CRDL	Contract-required detection limit
CRQL	Contract-required quantitation limit
COC	Chain-of-custody
CTO	Contract task order
DOT	Department of Transportation
DQO	Data quality objectives
DTSC	California Department of Toxic Substances Control
EDD	Electronic data deliverable
EPA	U.S. Environmental Protection Agency
FTL	Field Team Leader
FSP	Field sampling plan
GC/MS	Gas chromatograph/mass spectrometer
IDW	Investigative derived waste
LCS	Laboratory control sample
LUFT	Leaking underground fuel tank
MS/MSD	Matrix spike/matrix spike duplicate
PARCC	Precision, accuracy, representativeness, completeness, and comparability
PAH	Polynuclear aromatic hydrocarbon
PRC	PRC Environmental Management, Inc.
QA/QC	Quality assurance/quality control
QAPP	Quality assurance project plan
QCSR	Quality control summary report
RI	Remedial investigation
RPD	Relative percent difference
SDG	Sample delivery group
SOW	Statement of work
SVOC	Semivolatile organic compound
SWRCB	California State Water Resources Control Board
TEPH	Total extractable petroleum hydrocarbons
TPPH	Total purgeable petroleum hydrocarbons
TiEMI	Tetra Tech Em Inc.
TPPH	Total purgeable petroleum hydrocarbons
VOC	Volatile organic compound

## 1.0 INTRODUCTION

This quality assurance project plan (QAPP) is an appendix to the Site 14 Groundwater Investigation and Site 25 Remedial Investigation (RI) Field Sampling Plan (FSP) for Alameda Point (Tetra Tech EM Inc. [TtEMI] 1998). As a companion document, this QAPP specifies the procedures, and quality assurance/quality control (QA/QC) requirements necessary to collect environmental data of sufficient quantity and quality to meet the project objectives identified in the FSP. This QAPP specifies how QA/QC activities will be planned, implemented, and assessed for the duration of the project.

The Sites 14 and 25 FSP/QAPP contains many similar elements to previous work plans and QAPPs prepared for RI/FS activities at Alameda Point (PRC Environmental Management, Inc. [PRC] and Montgomery Watson 1993); however, based on new U.S. Environmental Protection Agency (EPA) guidelines (EPA 1994a), some elements have been revised (i.e. data quality objectives [DQO]s have been revised to provide better rationale for calculating sampling frequencies and determining sampling locations). The Sites 14 and 25 FSP/QAPP is intended as a "stand alone" document.

The Sites 14 and 25 FSP and QAPP have been prepared in accordance with EPA guidance document "Requirements for Quality Assurance Project Plans for Environmental Data Operations," EPA QA/R-5 (EPA 1994a) and meet the requirements for collection of data for the purposes of risk assessment, site characterization, evaluation of alternatives, engineering design, and monitoring implementation. EPA QA/R-5 states that the requirements for a QAPP are that (1) data quality objectives (DQO) are identified, (2) the intended measurements and data acquisitions are appropriate, (3) the QA/QC is sufficient for confirming the quality of data, and (4) limitations on the use of the data can be identified. These QAPP requirements have been presented as four components: (1) quality objectives and criteria for measurement data, (2) documentation and records, (3) measurement and data acquisition, and (4) assessment and oversight.

## 2.0 PROJECT MANAGEMENT

This section discusses the organizational structure for project management, including the roles and responsibilities of each project team member. The Alameda Point investigations will be staffed by a team with the experience and training necessary to maintain consistent quality throughout the project. The team members and their responsibilities are as follows:

## **PROJECT POSITION**

Navy Remedial Project Manager:  
TtEMI Navy CLEAN II Program Manager:  
TtEMI Project Manager:  
Navy QA Officer:  
TtEMI QA Program Manager:  
TtEMI Health and Safety Program Manager:  
TtEMI Project Chemist:  
TtEMI Field Team Leader:

## **TEAM MEMBER**

Patricia McFadden  
Daniel Chow  
Neal Hutchison  
Paul West  
Ron Riesing  
Conrad Sherman  
John Lane  
Scott Henderson

### **2.1 RESPONSIBILITIES**

The specific responsibilities of the primary team members are listed in the following paragraphs.

#### **Navy Remedial Project Manager**

The Navy Remedial Project Manager (RPM) is responsible for the following:

- Providing site information and history
- Providing logistical assistance
- Specifying sites requiring characterization
- Reviewing results and recommendations and providing management and technical oversight
- Ensuring proper review and distribution of project plans, characterization reports, and other documents
- Communicating comments from technical reviewers to contractors
- Ensuring that contractors address comments and take appropriate corrective actions
- Coordinating with regulatory agencies

#### **TtEMI Navy CLEAN II Program Manager**

The TtEMI Navy CLEAN II Program Manager establishes program policies and procedures, monitors costs and performances, delegates authority, and resolves conflicts and problems. The Program Manager is responsible for the following:

- Ensuring that contract requirements are met
- Providing necessary resources to the project team to allow adequate response to requirements of the investigation
- Maintaining consistency in procedures and work products among all task orders
- Establishing and maintaining communication between the RPM, QA Program Manager, health and safety Program Manager, and project managers
- Providing guidance to project managers as needed
- Assisting the program QA manager in resolving QA issues that cannot be handled at the Project Manager or QC coordinator level
- Assisting the program QA manager with QA issues with subcontractors, if necessary
- Monitoring compliance of project managers with orders and recommendations

#### **TtEMI Project Manager**

The TtEMI Project Manager is responsible for overseeing project activities and is ultimately responsible for the timely completion of the project. Responsibilities of the TtEMI Project Manager include the following:

- Assigning technical staff
- Developing work plans that define the scope of activities and the level of documentation and QC required
- Ensuring the completion of QC requirements of the work plan by team members
- Working with QC coordinators to implement quality improvements identified during the audit and review of ongoing work
- Approving deliverables and associated documents prior to transmittal
- Procuring subcontractors and preparing statements of work for subcontractors
- Establishing and maintaining communication among technical staff, the Program Manager, the QA officer, the TtEMI Health and Safety Program Manager, and regulatory agencies
- Implementing programs and protocols related to the project

### **Navy QA Officer**

The Navy QA Officer is responsible for the following:

- Reviewing of QC documentation, audits, and technical operations, as required
- Interacting with TtEMI's QA Program Manager about certification of laboratories, and coordinating QA and technical staff compliance with requirements
- Providing guidance to TtEMI's QA Program Manager in the correction of nonconformance issues
- Making recommendations to TtEMI's QA Program Manager regarding QA/QC topics and corrective actions
- Serving as the main Navy contact for program QA matters, and providing guidance on appropriate procedures to TtEMI's QA Program Manager

### **TtEMI QA Program Manager**

The TtEMI QA Program Manager develops and maintains a comprehensive QA program and is responsible for audits, reviews of work performed, and recommendations to technical staff and management regarding quality. The TtEMI QA Program Manager has the following specific responsibilities:

- Developing and revising the QA program, as required
- Assigning qualified personnel to serve as QC coordinators
- Implementing and supervising the QA program with the assistance of QC coordinators and subcontractor QA managers
- Coordinating the auditing and review of QC documentation and technical operations, as required
- Identifying nonconformance situations to the TtEMI CLEAN II Program Manager
- Providing guidance to the TtEMI CLEAN II Program Manager in the correction of nonconformance
- Interacting with the Navy's appointed QA officer about laboratories' certification requirements, and coordinating QA and technical staff compliance with requirements

- Making recommendations to the TtEMI CLEAN II Program Manager regarding QA/QC topics and corrective action

### **TtEMI Health and Safety Program Manager**

The TtEMI Health and Safety Program Manager is responsible for developing health and safety standards, implementing health and safety policies, and providing consultation to management for the Navy CLEAN Program. Specific responsibilities include the following:

- Keeping management informed on the status of the Navy CLEAN Health and Safety Program
- Participating in audits to evaluate compliance with the Alameda Point Base-wide Health and Safety Plan (HSP) and TtEMI's CLEAN II Health and Safety Program
- Reviewing site-specific HSPs for technical content and compliance with Health and Safety Program requirements
- Developing, implementing, and assessing the needs of the Health and Safety Program and informing TtEMI's health and safety coordinators of changes that occur within this program
- Providing consultation on health and safety policy and procedural issues as it relates to the Navy CLEAN Health and Safety Program
- Providing guidance on appropriate corrective action procedures to the Project Manager and support personnel

### **TtEMI Project Chemist**

The TtEMI Project Chemist is responsible for the following:

- Ensuring that the laboratory implements the analytical requirements of the QAPjP and the sampling and analysis plan (SAP)
- Ensuring that the laboratory adheres to the TtEMI "Navy Comprehensive Long-term Environmental Action Navy (CLEAN II) Laboratory Services Statement of Work (SOW)" (PRC 1995)
- Coordinating with the laboratory on project-specific requirements, delivery schedules, and QA/QC matters
- Reviewing laboratory data prior to release to the data users and the Navy
- Coordinating data validation activities

- Ensuring accuracy of the database entries for sample tracking, laboratory chemical data, and data validation qualifiers
- Providing updates on the project to the QA officer and Project Manager with regard to the QA/QC data

### **TtEMI Field Team Leader**

The TtEMI Field Team Leader (FTL) is responsible for field activities including the following:

- Directing on-site activities, including those of subcontractors
- Ensuring that procedures described in the SAP are adhered to in the field
- Ordering necessary supplies, equipment, and personal protective equipment (PPE)
- Ensuring that field equipment is properly calibrated and maintained
- Perform Site Safety Officer (SSO) duties, including training, safety briefings, and complying with applicable standards.
- Ensuring that individual samples are properly handled and documented to allow tracing the possession and handling of samples from collection to laboratory receipt
- Acting as the liaison between TtEMI and Navy personnel on base during the course of the field work
- Communicating with the TtEMI Project Chemist on any problems encountered with the collection of samples or the sampling schedule
- Communicating any problems to the subcontractors and TtEMI Project Managers in a timely manner

## **2.2 FIELD SAMPLING PERSONNEL TRAINING REQUIREMENTS**

Field personnel scheduled for work at Alameda Point will be trained in compliance with the U.S. Occupational Safety and Health Administration (OSHA) requirements, as found in Title 29 of the Code of Federal Regulations (CFR) 1910.120, and will be experienced in hazardous waste site work, use of PPE, and emergency response procedures. The TtEMI FTL/SSO will have received the annual 8-hour health and safety refresher training. The TtEMI FTL will also have received the 8-hour health and safety training for supervisors. The TtEMI FTL/SSO will be current in cardiopulmonary resuscitation (CPR) and first aid training.

TtEMI, team firm, and subcontractor field personnel assigned to the Sites 14 and 25 investigations will receive copies of the FSP, QAPP, and the Alameda Point Base-wide HSP prior to commencement of field activities. A field staff orientation and briefing will be held prior to the initiation of field activities, as specified in the Alameda Point Base-wide HSP.

### **3.0 DATA QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA**

DQOs are qualitative and quantitative statements developed by data users to specify the quality of data needed from a particular data collection activity to support specific decisions or regulatory actions. For the groundwater investigation and the GAP closure at Site 14, and the RI at Site 25, the site backgrounds, statement the problems, DQOs, and the sampling designs are identified in Sections 2 and 3 of the FSP (TtEMI 1998). Based on the DQOs, both screening or definitive analytical data will be collected for this project. Each of these data categories is defined by specific QA/QC procedures using a wide range of analytical methods. Screening and definitive data categories are described in Section 3.1. Appropriate analytical methods for each data category are described in Section 5.

Measurement objectives are described as the critical indicator parameters of data quality, and are precision, accuracy, representativeness, completeness, and comparability (PARCC). The following subsections discuss and provide definitions for the data categories, PARCC parameters, and quantitation limits.

#### **3.1 DATA CATEGORIES**

The following definitions for screening data and definitive data are from "Data Quality Objectives Process for Superfund Interim Final Guidance" (EPA 1993).

##### **Screening Data**

Screening data are data generated by rapid, less precise methods of analysis with less rigorous sample preparation. Screening data provides rapid results for decision making in the field. Screening data provide analyte identification and quantification, although quantification may be relatively imprecise. At least 10 percent of the screening data are confirmed using analytical methods and QA/QC procedures and criteria associated with definitive data. Screening data without associated confirmation data are not



considered to be data of known quality. The minimum QA/QC elements required for the screening data are:

- Sample documentation (location, date and time collected, batch, etc.).
- Chain of custody (when appropriate).
- Sampling design approach (systematic, simple or stratified random, judgmental, etc.).
- Initial and continuing calibration.
- Determination and documentation of detection limits.
- Analyte(s) identification.
- Analyte(s) quantitation.
- Analytical error determination or duplicate precision: an appropriate number of replicate aliquots, as specified in the QAPP and FSPs, are taken from at least one thoroughly homogenized sample, the replicate aliquots are analyzed, and standard laboratory QC parameters (such as variance, mean, and coefficient of variation or relative percent difference) are calculated and compared to method-specific performance requirements specified in the QAPP.
- Definitive confirmation: at least 10 percent of the screening data must be confirmed with definitive data as described below. As a minimum, at least three screening samples reported above the action level (if any) and three screening samples reported below the action level (or as non-detects, ND) should be randomly selected from the appropriate group and confirmed.

For the Site 14 groundwater investigation, a modified version of SW-846 Method 8260A will be used to analyze water samples in the field for chlorinated volatile organic compounds (VOC). Performance criteria for SW-846 Method 8260A have been modified for implementation in the field and are described in Section 5. Water samples will be analyzed in the field for total extractable petroleum hydrocarbons (TEPH) in accordance with SW-846 Method 8015 and the *Leaking Underground Fuel Tank (LUFT) Field Manual* (California State Water Resources Control Board [SWRCB] 1988), from this point forward referred to as SW-846 Method 8015M.

### **Definitive Data**

Definitive data are data generated using rigorous analytical methods, such as approved EPA reference methods. Definitive data provide defensible data useable for characterization and assessment purposes. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce tangible raw data in the form of paper printouts or computer-generated electronic files. Data may be

generated at the site or at an off-site location, as long as the QA/QC requirements are satisfied. For the data to be definitive, either analytical or total measurement error must be determined. QA/QC elements required for definitive data include the following:

- Sample documentation (location, date and time collected, batch, etc.)
- Chain-of-custody (when appropriate)
- Sampling design approach (systematic, simple or stratified random, judgmental)
- Initial and continuing calibration
- Determination and documentation of detection limits
- Analyte identification
- Analyte quantitation
- QC blanks (trip, method, rinsate)
- Matrix spike recoveries
- Performance evaluation samples (when specified)
- Matrix duplicate. For two or more aliquots this is also referred to as the analytical error determination (measures precision of analytical method): an appropriate number of replicate aliquots, as specified in the QAPP, are taken from at least one thoroughly homogenized sample, the replicate aliquots are analyzed, and standard laboratory QC parameters are calculated and compared to method-specific performance requirements defined in the QAPP.
- Field duplicates or total measurement error determination (measures overall precision of measurement system, from sample acquisition through analysis): an appropriate number of co-located samples are independently collected from the same location and analyzed following standard operating procedures. The variance, mean, coefficient of variation, or relative percent difference are calculated for specific matrices.

Definitive data methods for the groundwater investigation at Site 14 and the RI at Site 25 are described in Section 5.

### **3.2 PARCC CRITERIA**

PARCC are critical indicators of project data quality (EPA 1987a). Measurement objectives for these indicator parameters were developed based on past experience of the project, limitations of the analytical methods, and on the project DQOs. The following sections describe the PARCC parameters.

### 3.2.1 Precision

Precision is the degree of mutual agreement between individual measurements of the same property under prescribed similar conditions. For duplicate measurements, precision is expressed as the relative percent difference (RPD) of the pair and is calculated using the following:

$$RPD = \frac{|D_1 - D_2|}{\frac{1}{2}(D_1 + D_2)} \times 100\%$$

where:  $D_1$  = Concentration of analyte in original sample  
 $D_2$  = Concentration of analyte in duplicate sample

The precision of chemical analyses or analytical methods will be assessed through the analysis of matrix spike/matrix spike duplicate (MS/MSD) samples and matrix duplicate samples. Each QC sample type will provide unique information regarding the precision of the laboratory programs, as described below:

- MS/MSD samples: Laboratory analytical precision for organic analyses
- Matrix duplicate samples: Laboratory analytical precision for inorganic/physical parameters

Precision acceptance criteria for duplicate and MS/MSD samples for all analytical methods are presented in Section 5. Due to the non-homogeneous nature of soil samples, collection of field duplicate samples is not planned for soil samples collected at Site 25.

The precision for field measurements will be evaluated based on the results of duplicate measurements. At least 10 percent of the field screening measurements will be obtained in duplicate. In addition, confirmation samples (definitive data confirming field screening data) will be collected randomly at the frequency of at least 15 percent of the samples collected as screening data.

The precision between confirmation data and screening data is limited to the precision of the selected screening method, since the screening data have the least stringent QA/QC criteria and confirmation data have the most stringent QA/QC criteria. However, if the precision between confirmation data and screening data is determined to be outside the acceptance criteria, the screening data may still be useful.

For example, there may be a useful correlation between confirmation sample results with screening results, even if the screening results are discovered to be consistently biased high (or low). In these cases, the DQO for the screening data will be considered as to whether the screening data can be used in the absence of good precision with confirmation data.

When analytes are present in samples either near the method detection limit or substantially above the detection limit, the precision objectives for MS/MSD analyses may not be appropriate. If precision objectives are not met, other QC data will be evaluated to determine the validity of the data.

### **3.2.2 Accuracy**

Accuracy refers to the degree to which a measurement agrees with its true value. The accuracy of an analytical measurement is impacted by errors introduced through the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analytical techniques. Sampling accuracy will be evaluated based on the analytical results of the field blanks, trip blanks, and equipment rinsate blanks. To evaluate laboratory accuracy, a program of sample spiking will be conducted by the analytical laboratory. This program includes the analysis of MS/MSD samples, laboratory control samples (LCS) or blank spikes, and surrogate standards. MS/MSD samples are analyzed at a frequency of 5 percent; LCS or blank spike at a frequency of 5 percent; and surrogate standards, where applicable, are added to every sample analyzed for organic constituents. Accuracy is expressed in terms of percent recovery and is calculated by the following equation:

$$\text{Percent Recovery} = \frac{(\text{Measured Spike Value} - \text{Unspiked Value})}{(\text{Known Spiked Value})} \times 100\%$$

The results of spiked samples are expressed as percent recovery and will provide information on positive and negative bias. Accuracy goals for each specific method are presented in Section 5 of this QAPP.

### **3.2.3 Representativeness**

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, parameter variations at a sampling point, or an environmental condition they are intended to represent. Representativeness is a qualitative parameter; hence, no specific criteria

must be met. For this project, representative data will be obtained through the careful selection of sampling locations and analytical parameters, the proper collection and handling of samples to avoid interferences and minimize sample contamination and loss of analytes, and the use of standardized field and laboratory procedures and their consistent application. To aid in the evaluation of the representativeness of each sample, field- and laboratory-required blank samples are evaluated for the presence of contaminants. Method blank samples will be considered in evaluating the validity of the data when there are problems with contamination in any samples.

#### **3.2.4 Completeness**

Completeness is defined as the percentage of measurements that are judged valid. The project completeness value will be determined at the conclusion of the data validation phase and will be calculated by dividing the number of complete, valid sample results by the total number of sample analyses planned for the project. The data validation process will determine whether a particular data point is a valid result that is acceptable for all uses, an estimated result that is acceptable for limited uses, or a rejected result that is unacceptable for any use. Complete results are defined as results that are considered valid and include estimated results. Sample results that are considered rejected, unacceptable, and unusable when compared to QC criteria are listed as incomplete. The completeness objective for both the groundwater investigation and GAP closure at Site 14, and the RI at Site 25, is 95 percent for definitive data and field screening data.

#### **3.2.5 Comparability**

Comparability is a qualitative parameter that expresses the confidence with which one data set may be compared to another. This goal is achieved through the use of standardized techniques to collect samples, the use of standardized analytical methods, and the use of appropriate units to report analytical results. All analytical laboratories performing work for the Navy must comply with TtEMI's laboratory services (SOW) (PRC 1995), which specifies analytical protocols, QC criteria, and standard deliverables, promoting comparable data.

### 3.3

## DETECTION AND QUANTITATION LIMITS

The instrument detection limit is the minimum concentration of an analyte that can be distinguished from the normal electronic "noise" of an analytical instrument, and is statistically determined. The quantitation limit is the lowest concentration at which an analyte can be accurately and reproducibly quantified. Quantitation limits vary depending on instrument sensitivity and sample matrix effects.

Contract-required quantitation limits (CRQL) and contract-required detection limits (CRDL) are the minimum quantitation limits that are contractually required for analyses performed under EPA Contract Laboratory Procedure (CLP) protocols. VOCs and semivolatile organic compounds (SVOC) analyzed by the CLP method are required to be reported to the CRQL as specified in the CLP SOW (EPA 1994b). Total metals analyzed by the CLP method are required to be reported to the CRDL as specified in the CLP SOW (EPA 1995). All other non-CLP methods, including polynuclear aromatic hydrocarbons (PAH), field-analyzed VOCs, total purgeable petroleum hydrocarbons (TPPH), TEPH, and benzene, toluene, ethylbenzene and total xylenes (BTEX) analyzed by SW-846 methods (EPA 1986) are required to be reported to the quantitation limits as specified in the TtEMI laboratory services SOW (PRC 1995).

For soil samples, all CRQLs, CRDLs, and quantitation limits are required to be reported based on the dry weight of the sample. In other words, quantitation limits are adjusted based on moisture content of the soil. CRQLs and quantitation limits for each specific method are presented in Section 5 of this QAPP.

## 4.0 DOCUMENTATION AND RECORDS

This section describes the field documentation requirements for the proposed field activities for the Site 14 and Site 25 investigations and includes the overall sample handling process.

### 4.1 SAMPLE IDENTIFICATION

Samples will be identified to provide a means of tracking each sample from collection through analysis, data reduction, reporting, and validation. A field identification system and a laboratory identification system have been established for Alameda Point to efficiently manage sample tracking and referencing and to provide a means of submitting blind samples to the laboratory. The following subsections describe sample identification procedures in detail.

#### 4.1.1 Field Identification System

All samples collected will be assigned a field number on the basis of an alphanumeric code that will be unique and easily transcribed. Samples collected at Site 14 will be identified with a three-part identification code consisting of site number, boring number, and sample depth as follows:

<u>Site Number</u>	<u>Boring Number</u>	<u>Sample Depth</u>
S14	2-4	8

The site number designates which site the sample was collected. The boring number designates the push-sampling location within the site as presented in Tables 1 and 3 in the FSP. The sample depth indicates the top depth in feet at which the sample is collected.

Samples collected at Site 25 will be identified with a three-part identification code consisting of site number, sample number, and depth as follows:

<u>Site Number</u>	<u>Boring Number</u>	<u>Sample Depth</u>
S25	SB-1	1

The site number designates which site the sample was collected. The boring number represents a discrete identification for each soil sample collected from the site. The sample depth indicates the top depth in feet at which the sample was collected.

#### 4.1.2 Laboratory Identification System

Each sample will be assigned a unique identifier, apart from the field identification number, to provide a means of submitting the samples blind to the laboratory. The number will be based on a three-part alphanumeric code, as follows:

<u>CTO Number</u>	<u>Site Code</u>	<u>Sample Number</u>
122	S14	001

The "122" represents CLEAN II contract task order (CTO) number 122, under which the field work and sample analyses will be performed. The "S14" references the site from which the samples are collected.



The last set of numbers represent an arbitrary sample number, sequentially assigned to each sample. This number will be used to cross-reference the field identification number.

Because the Site 14 sampling design described in Section 2 of the FSP requires decision making in the field with respect to where groundwater samples will be collected and at what depth, Table A-1 presents only the field and laboratory identification numbers for the initial groundwater samples to be collected at Site 14. Additional groundwater samples may be collected based on field data from the initial samples. In addition, subsurface soil samples may be collected at locations where potential sources have been identified based on the groundwater investigation. Table A-1 will be updated with additional sample information throughout the project. Sample IDs for surface soil samples collected at GAP 9 are also presented in Table A-1. Corresponding field identification numbers and the analytical methods to be performed for each sample are also given. Field and laboratory identification numbers, the corresponding field identification numbers and, the analytical methods to be performed for all soil samples to be collected at Site 25 are presented in Table A-2.

## **4.2 SAMPLE HANDLING**

Sample collection methods are described in the work plan. Sample handling procedures are described in the following sections.

### **4.2.1 Sample Containers and Labels**

Soil and groundwater samples will be containerized as described in the work plan. The contracted laboratory will provide clean containers with caps, which meet CLP container guidelines for CLP methods. A sample label will be affixed to each sample container sent to the laboratory. The sample label will be completed in indelible ink and include the following information:

- |                                     |                      |
|-------------------------------------|----------------------|
| • Project name and location:        | <b>Alameda Point</b> |
| • Site name:                        | <b>S14</b>           |
| • Laboratory identification number: | <b>122-S14-001</b>   |
| • Date of sample collection:        | <b>x/xx/98</b>       |
| • Preservative used:                | <b>N/A</b>           |
| • Sampler's initials:               | <b>XXX</b>           |
| • Sample type:                      | <b>Soil/Water</b>    |
| • Analyses requested:               | <b>VOCs</b>          |

**TABLE A-1**  
**FIELD AND LABORATORY IDENTIFICATION NUMBERS**  
**FOR GROUNDWATER, SOIL, AND QC SAMPLES**  
**SITE 14**  
**ALAMEDA POINT**

CHLORINATED SOLVENT AND TPH PLUME INVESTIGATION GROUNDWATER SAMPLES							
Laboratory Identification	Field Identification	Matrix	VOC Field-Lab Analysis	VOC Fixed-Lab Analysis	SVOC	Field-Lab TEPH	Fixed-Lab TEPH
122-S14-001	S14-2-4-8	Water	x	x	x	x	x
122-S14-002	S14-2-4-8Dup	Water	x	x	x	x	x
122-S14-003	S14-2-4-10	Water	x			x	
122-S14-004	S14-2-4-12	Water	x			x	
122-S14-005	S14-2-4-14	Water	x			x	
122-S14-006	S14-3-3-8	Water	x			x	
122-S14-007	S14-3-3-10	Water	x			x	
122-S14-008	S14-3-3-12	Water	x			x	
122-S14-009	S14-3-3-14	Water	x	x	x	x	x
122-S14-010	S14-3-4-8	Water	x			x	
122-S14-011	S14-3-4-10	Water	x			x	
122-S14-012	S14-3-4-12	Water	x			x	
122-S14-013	S14-3-4-12Dup	Water	x			x	
122-S14-014	S14-3-4-14	Water	x			x	
122-S14-015	S14-3-5-8	Water	x			x	
122-S14-016	S14-3-5-10	Water	x			x	
122-S14-017	S14-3-5-12	Water	x	x	x	x	x
122-S14-018	S14-3-5-14	Water	x			x	
122-S14-019	S14-4-2-8	Water	x			x	
122-S14-020	S14-4-2-10	Water	x			x	
122-S14-021	S14-4-2-12	Water	x			x	
122-S14-022	S14-4-2-14	Water	x			x	
122-S14-023	S14-4-4-8	Water	x			x	
122-S14-024	S14-4-4-8Dup	Water	x			x	
122-S14-025	S14-4-4-10	Water	x	x	x	x	x
122-S14-026	S14-4-4-12	Water	x			x	

TABLE A-1 (continued)

**FIELD AND LABORATORY IDENTIFICATION NUMBERS  
FOR GROUNDWATER, SOIL, AND QC SAMPLES  
SITE 14  
ALAMEDA POINT**

<b>CHLORINATED SOLVENT AND TPH PLUME INVESTIGATION GROUNDWATER SAMPLES</b>							
<b>Laboratory Identification</b>	<b>Field Identification</b>	<b>Matrix</b>	<b>VOC Field-Lab Analysis</b>	<b>VOC Fixed-Lab Analysis</b>	<b>SVOC</b>	<b>Field-Lab TEPH</b>	<b>Fixed-Lab TEPH</b>
122-S14-027	S14-4-4-14	Water	x			x	
122-S14-028	S14-5-1-8	Water	x			x	
122-S14-029	S14-5-1-10	Water	x			x	
122-S14-030	S14-5-1-12	Water	x			x	
122-S14-031	S14-5-1-14	Water	x			x	
122-S14-032	S14-5-2-8	Water	x	x	x	x	x
122-S14-033	S14-5-2-10	Water	x			x	
122-S14-034	S14-5-2-10Dup	Water	x			x	
122-S14-035	S14-5-2-12	Water	x			x	
122-S14-036	S14-5-2-14	Water	x			x	
122-S14-037	S14-5-3-8	Water	x			x	
122-S14-038	S14-5-3-10	Water	x			x	
122-S14-039	S14-5-3-12	Water	x			x	
122-S14-040	S14-5-3-14	Water	x	x	x	x	x
122-S14-041	S14-5-5-8	Water	x			x	
122-S14-042	S14-5-5-10	Water	x			x	
122-S14-043	S14-5-5-12	Water	x			x	
122-S14-044	S14-5-5-14	Water	x			x	
122-S14-045	S14-5-5-14Dup	Water	x			x	
122-S14-046	S14-6-2-8	Water	x			x	
122-S14-047	S14-6-2-10	Water	x			x	
122-S14-048	S14-6-2-12	Water	x	x	x	x	x
122-S14-049	S14-6-2-14	Water	x			x	
122-S14-050	S14-6-4-8	Water	x			x	
122-S14-051	S14-6-4-10	Water	x			x	
122-S14-052	S14-6-4-12	Water	x			x	

TABLE A-1 (continued)

**FIELD AND LABORATORY IDENTIFICATION NUMBERS  
FOR GROUNDWATER, SOIL, AND QC SAMPLES  
SITE 14  
ALAMEDA POINT**

<b>CHLORINATED SOLVENT AND TPH PLUME INVESTIGATION GROUNDWATER SAMPLES</b>							
<b>Laboratory Identification</b>	<b>Field Identification</b>	<b>Matrix</b>	<b>VOC Field-Lab Analysis</b>	<b>VOC Fixed-Lab Analysis</b>	<b>SVOC</b>	<b>Field-Lab TEPH</b>	<b>Fixed-Lab TEPH</b>
122-S14-053	S14-6-4-14	Water	x			x	
122-S14-054	S14-6-5-8	Water	x			x	
122-S14-055	S14-6-5-10	Water	x	x	x	x	x
122-S14-056	S14-6-5-10Dup	Water	x	x	x	x	x
122-S14-057	S14-6-5-12	Water	x			x	
122-S14-058	S14-6-5-14	Water	x			x	
122-S14-059	S14-6-6-8	Water	x			x	
122-S14-060	S14-6-6-10	Water	x			x	
122-S14-061	S14-6-6-12	Water	x			x	
122-S14-062	S14-6-6-14	Water	x	x		x	
122-S14-063	TB-S14-1	Water		x			
122-S14-064	TB-S14-2	Water		x			
122-S14-065	TB-S14-3	Water		x			
122-S14-066	TB-S14-4	Water		x			
122-S14-067	TB-S14-5	Water		x			
122-S14-068	ER-S14-1	Water		x	x		x
122-S14-069	ER-S14-2	Water		x			
122-S14-070	ER-S14-3	Water		x			
122-S14-071	ER-S14-4	Water		x			
122-S14-072	FB-S14-1	Water	x	x	x	x	x
Site 14 groundwater sample numbers will be continued based on field analysis results							

TABLE A-1 (continued)

**FIELD AND LABORATORY IDENTIFICATION NUMBERS  
FOR GROUNDWATER, SOIL, AND QC SAMPLES**

**SITE 14  
ALAMEDA POINT**

GENERATION ACCUMULATION POINTS 9a AND 9B SOIL SAMPLES						
Laboratory Identification	Field Identification	Matrix	VOC	SVOC	TEPH	Total Metals
122-GAP9-001	GAP9a-1	Soil	x	x	x	x
122-GAP9-002	GAP9a-2	Soil	x	x	x	x
122-GAP9-003	GAP9a-3	Soil	x	x	x	x
122-GAP9-004	GAP9a-4	Soil	x	x	x	x
122-GAP9-005	GAP9a-5	Soil	x	x	x	x
122-GAP9-006	GAP9b-1	Soil	x	x	x	x
122-GAP9-007	GAP9b-2	Soil	x	x	x	x
122-GAP9-008	GAP9b-3	Soil	x	x	x	x
122-GAP9-009	GAP9b-4	Soil	x	x	x	x
122-GAP9-010	GAP9b-5	Soil	x	x	x	x
122-GAP9-011	TB-GAP9-1	Water	x			
122-GAP9-012	TB-GAP9-2	Water	x			
122-GAP9-013	ER-GAP9-1	Water	x	x	x	x
122-GAP9-014	ER-GAP9-2	Water	x	x	x	x
122-GAP9-015	FB-GAP9-1	Water	x	x	x	x

## Notes:

VOC = Volatile organic compound  
 SVOC = Semivolatile organic compound  
 TEPH = Total extractable petroleum hydrocarbons  
 TB = Trip blank  
 ER = Equipment Rinsate  
 FB = Field Blank  
 Dup = Duplicate

TABLE A-2

**FIELD AND LABORATORY IDENTIFICATION NUMBERS  
FOR SOIL, GROUNDWATER, AND QC SAMPLES**

**SITE 25  
ALAMEDA POINT**

Laboratory Identification	Field Identification	Matrix	PAH	TPPH	TEPH	BTEX
122-S25-001	S25-SB-1-1	Soil	x	x	x	x
122-S25-002	S25-SB-1-4	Soil	x	x	x	x
122-S25-003	S25-SB-1-7	Soil	x	x	x	x
122-S25-004	S25-SB-1-10	Soil	x	x	x	x
122-S25-005	S25-SB-2-1	Soil	x	x	x	x
122-S25-006	S25-SB-2-7	Soil	x	x	x	x
122-S25-007	S25-SB-3-1	Soil	x	x	x	x
122-S25-008	S25-SB-3-4	Soil	x	x	x	x
122-S25-009	S25-SB-3-7	Soil	x	x	x	x
122-S25-010	S25-SB-3-10	Soil	x	x	x	x
122-S25-011	S25-SB-4-1	Soil	x	x	x	x
122-S25-012	S25-SB-4-7	Soil	x	x	x	x
122-S25-013	S25-SB-5-1	Soil	x	x	x	x
122-S25-014	S25-SB-5-7	Soil	x	x	x	x
122-S25-015	S25-SB-6-1	Soil	x	x	x	x
122-S25-016	S25-SB-6-7	Soil	x	x	x	x
122-S25-017	S25-SB-7-1	Soil	x	x	x	x
122-S25-018	S25-SB-7-4	Soil	x	x	x	x
122-S25-019	S25-SB-7-7	Soil	x	x	x	x
122-S25-020	S25-SB-7-10	Soil	x	x	x	x
122-S25-021	S25-SB-8-1	Soil	x	x	x	x
122-S25-022	S25-SB-8-7	Soil	x	x	x	x
122-S25-023	S25-SB-9-1	Soil	x	x	x	x
122-S25-024	S25-SB-9-7	Soil	x	x	x	x
122-S25-025	S25-SB-10-1	Soil	x	x	x	x
122-S25-026	S25-SB-10-7	Soil	x	x	x	x
122-S25-027	S25-SB-11-1	Soil	x	x	x	x
122-S25-028	S25-SB-11-7	Soil	x	x	x	x
122-S25-029	S25-SB-12-1	Soil	x	x	x	x

TABLE A-2 (continued)

**FIELD AND LABORATORY IDENTIFICATION NUMBERS  
FOR SOIL, GROUNDWATER, AND QC SAMPLES**

**SITE 25  
ALAMEDA POINT**

Laboratory Identification	Field Identification	Matrix	PAH	TPPH	TEPH	BTEX
122-S25-030	S25-SB-12-7	Soil	x	x	x	x
122-S25-031	S25-SB-13-1	Soil	x	x	x	x
122-S25-032	S25-SB-13-7	Soil	x	x	x	x
122-S25-033	S25-SB-14-1	Soil	x	x	x	x
122-S25-034	S25-SB-14-4	Soil	x	x	x	x
122-S25-035	S25-SB-14-7	Soil	x	x	x	x
122-S25-036	S25-SB-14-10	Soil	x	x	x	x
122-S25-037	S25-SB-15-1	Soil	x	x	x	x
122-S25-038	S25-SB-15-7	Soil	x	x	x	x
122-S25-039	S25-SB-16-1	Soil	x	x	x	x
122-S25-040	S25-SB-16-7	Soil	x	x	x	x
122-S25-041	S25-SB-17-1	Soil	x	x	x	x
122-S25-042	S25-SB-17-7	Soil	x	x	x	x
122-S25-043	S25-SB-18-1	Soil	x	x	x	x
122-S25-044	S25-SB-18-4	Soil	x	x	x	x
122-S25-045	S25-SB-18-7	Soil	x	x	x	x
122-S25-046	S25-SB-18-10	Soil	x	x	x	x
122-S25-047	S25-SB-19-1	Soil	x	x	x	x
122-S25-048	S25-SB-19-7	Soil	x	x	x	x
122-S25-049	S25-SB-20-1	Soil	x	x	x	x
122-S25-050	S25-SB-20-7	Soil	x	x	x	x
122-S25-051	S25-SB-21-1	Soil	x	x	x	x
122-S25-052	S25-SB-21-4	Soil	x	x	x	x
122-S25-053	S25-SB-21-7	Soil	x	x	x	x
122-S25-054	S25-SB-21-10	Soil	x	x	x	x
122-S25-055	S25-SB-22-1	Soil	x	x	x	x
122-S25-056	S25-SB-22-7	Soil	x	x	x	x
122-S25-057	S25-SB-23-1	Soil	x	x	x	x
122-S25-058	S25-SB-23-7	Soil	x	x	x	x

TABLE A-2 (continued)

**FIELD AND LABORATORY IDENTIFICATION NUMBERS  
FOR SOIL, GROUNDWATER, AND QC SAMPLES**

**SITE 25  
ALAMEDA POINT**

Laboratory Identification	Field Identification	Matrix	PAH	TPPH	TEPH	BTEX
122-S25-059	S25-SB-24-1	Soil	x	x	x	x
122-S25-060	S25-SB-24-4	Soil	x	x	x	x
122-S25-061	S25-SB-24-7	Soil	x	x	x	x
122-S25-062	S25-SB-24-10	Soil	x	x	x	x
122-S25-063	S25-SB-25-1	Soil	x	x	x	x
122-S25-064	S25-SB-25-4	Soil	x	x	x	x
122-S25-065	S25-SB-25-7	Soil	x	x	x	x
122-S25-066	S25-SB-25-10	Soil	x	x	x	x
122-S25-067	S25-SB-26-1	Soil	x	x	x	x
122-S25-068	S25-SB-26-7	Soil	x	x	x	x
122-S25-069	S25-SB-27-1	Soil	x	x	x	x
122-S25-070	S25-SB-27-7	Soil	x	x	x	x
122-S25-071	S25-SB-28-1	Soil	x	x	x	x
122-S25-072	S25-SB-28-7	Soil	x	x	x	x
122-S25-073	S25-SB-29-1	Soil	x	x	x	x
122-S25-074	S25-SB-29-7	Soil	x	x	x	x
122-S25-075	S25-SB-30-1	Soil	x	x	x	x
122-S25-076	S25-SB-30-7	Soil	x	x	x	x
122-S25-077	S25-SB-31-1	Soil	x	x	x	x
122-S25-078	S25-SB-31-4	Soil	x	x	x	x
122-S25-079	S25-SB-31-7	Soil	x	x	x	x
122-S25-080	S25-SB-31-10	Soil	x	x	x	x
122-S25-081	S25-SB-32-1	Soil	x	x	x	x
122-S25-082	S25-SB-32-7	Soil	x	x	x	x
122-S25-083	S25-SB-33-1	Soil	x	x	x	x
122-S25-084	S25-SB-33-7	Soil	x	x	x	x
122-S25-085	S25-SB-34-1	Soil	x	x	x	x
122-S25-086	S25-SB-34-7	Soil	x	x	x	x
122-S25-087	S25-SB-35-1	Soil	x	x	x	x



TABLE A-2 (continued)

**FIELD AND LABORATORY IDENTIFICATION NUMBERS  
FOR SOIL, GROUNDWATER, AND QC SAMPLES  
SITE 25  
ALAMEDA POINT**

Laboratory Identification	Field Identification	Matrix	PAH	TPPH	TEPH	BTEX
122-S25-088	S25-SB-35-4	Soil	x	x	x	x
122-S25-089	S25-SB-35-7	Soil	x	x	x	x
122-S25-090	S25-SB-35-10	Soil	x	x	x	x
122-S25-091	S25-SB-1	Water	x	x	x	x
122-S25-092	S25-SB-3	Water	x	x	x	x
122-S25-093	S25-SB-7	Water	x	x	x	x
122-S25-094	S25-SB-14	Water	x	x	x	x
122-S25-095	S25-SB-18	Water	x	x	x	x
122-S25-096	S25-SB-20	Water	x	x	x	x
122-S25-097	S25-SB-20Dup	Water	x	x	x	x
122-S25-098	S25-SB-21	Water	x	x	x	x
122-S25-099	S25-SB-24	Water	x	x	x	x
122-S25-100	S25-SB-25	Water	x	x	x	x
122-S25-101	S25-SB-35	Water	x	x	x	x
122-S25-102	ER-1	Water	x	x	x	x
122-S25-103	ER-2	Water	x	x	x	x
122-S25-104	ER-3	Water	x	x	x	x
122-S25-105	ER-4	Water	x	x	x	x
122-S25-106	ER-5	Water	x	x	x	x
122-S25-107	ER-6	Water	x	x	x	x
122-S25-108	ER-7	Water	x	x	x	x
122-S25-109	FB-1	Water	x	x	x	x
122-S25-110	TB-1	Water				x
122-S25-111	TB-2	Water				x

## Notes:

TEPH = Total extractable petroleum hydrocarbons  
 TPPH = Total purgeable petroleum hydrocarbons  
 BTEX = Benzene, toluene, ethylbenzene, and xylenes  
 DUP = Duplicate

TB = Trip blank  
 ER = Equipment rinsate  
 FB = Field blank  
 SB = Soil Boring

After the label has been affixed to the sample container, the label will be covered with a wide strip of clear strapping tape to protect it from moisture damage during shipment and storage.

#### **4.2.2 Custody Seals**

To ensure that no tampering occurs, TtEMI will place custody seals on each cooler used to ship samples. Custody seals used during the course of the project will consist of security tape with the date and initials of the sampler. Two seals will be placed on each cooler so that they must be broken to gain access to the contents. Clear tape will be placed over the custody seals to protect them from accidental breakage.

#### **4.2.3 Chain-of-Custody**

Chain-of-custody (COC) procedures provide an accurate written record that traces the possession of individual samples from the time of field collection through laboratory analysis. A sample is considered in custody if it meets one of the following criteria:

- In a person's possession
- In view after having been in physical custody
- In a secure area after having been in physical custody
- In a designated secure area to which access is restricted to authorized personnel

A COC record will be used to document the samples collected and the analyses requested. Information that field personnel will record on the COC record includes the following:

- Project name and number
- Name and signature of sampler(s)
- Destination of samples (name of laboratory)
- Laboratory identification number
- Date and time of collection
- Sample designation (grab or composite)
- Sampling location
- Signatures of personnel involved in custody transfer

- Date and time of all transfers
- Air bill number, if applicable
- Number and size of containers
- Preservatives used, if any
- Sample matrix
- Analyses required
- Contract number (in upper left corner)

Unused lines on the COC record will be crossed out. COC records initiated in the field will be signed, placed in a plastic resealable bag, and taped to the inside of the shipping container used for sample transport. Signed air bills will serve as evidence of custody transfer between the field sampler and courier, and between the courier and the laboratory. Copies of the COC record and the air bill will be retained and filed by the sampler prior to shipment.

Upon receipt of an ice chest or shipping container, laboratory personnel will review the contents and will sign and retain the COC record and the air bill. Information that will be recorded on the COC record in the remarks column, or on another appropriate document, at the time of sample receipt will include the following, as appropriate:

- Status of custody seals
- Temperature of ice chest upon receipt
- Identification number of broken sample containers, if any
- Description of discrepancies between the COC record, sample labels, and requested analyses
- Observations of visible headspace in sample bottles, indicating inadequate sample collection

Laboratory personnel will contact the TtEMI project chemist regarding discrepancies in paperwork and sample preservation, and will document non-conformances and corrective actions in accordance with laboratory standard operating procedures.

After samples have been accepted by the laboratory, checked, and logged in, they will be maintained in a manner consistent with custody and security requirements specified in the EPA CLP SOW.

#### **4.2.4 Sample Preservation and Holding Times**

Methods of sample preservation are relatively limited and are generally intended to (1) retard biological degradation, (2) retard chemical degradation, and (3) reduce container adsorption effects. The proposed soil samples will be preserved by refrigeration to 4 °C, in accordance with EPA CLP protocols for CLP methods.

Upon receipt of the samples from the shipping company, the laboratory will make every effort to analyze all samples within the specified holding times for each analytical method. The field team will coordinate all sample shipments with the laboratory to reduce the possibility of these analyses exceeding the specified holding times. Holding times are presented in Table A-3.

#### **4.2.5 Sample Packaging and Shipping**

All soil samples collected during this project will be identified as environmental samples for the purpose of shipment. Environmental samples are defined as soil, water, or sediment that is not saturated with product material. All Department of Transportation (DOT) regulations will be followed for packaging and shipment. The following procedures, which are taken from EPA guidance on field operations methods (EPA 1987b), meet these DOT requirements.

- An ice chest will be lined with a large plastic bag. After the bag is in place, the ice chest will be filled with sample bottles that have been wrapped in bubble-wrap plastic. Any additional space between bottles will be filled with styrofoam, starch peanuts, or shredded paper. Sufficient packing material will be used to prevent sample containers from making contact during shipment. Sufficient bagged ice or blue ice will be added to the samples to maintain the ice chest at a temperature of 4°C during shipping. The large plastic bag will be securely taped shut to prevent leakage.
- COC records will be sealed in plastic bags and taped to the inside of the ice chest lid.
- The ice chest will be closed and taped shut with filament-type strapping tape on both ends. If the ice chest contains a drain, the drain will be taped closed both inside and outside.

TABLE A-3

**CONTAINERS, PRESERVATION, AND HOLDING TIME REQUIREMENTS  
FOR SOIL, WATER, AND QC SAMPLES  
ALAMEDA POINT**

Parameter	Matrix	EPA Method	Sample Container	Number of Containers	Preservative	Holding Time
VOCs	Soil	CLP	6-inch tube with Teflon-lined cap	1	Cool, 40C	14 days
	Water		40mL vials with Teflon-lined cap	3	HCl to pH<2, Cool, 40C	14 days (7 days if unpreserved)
PAHs	Soil	CLP	6-inch tube with Teflon-lined cap or 16-oz glass jar	1	Cool, 40C	14 days to extraction; additional 40 days to analysis
	Water		1-liter Amber glass bottle with Teflon-lined cap	2	Cool, 40C	7 days to extraction; additional 40 days to analysis
TPPH	Soil	8015M	6-inch tube with Teflon-lined cap or 16-oz glass jar	1	Cool, 40C	14 days
	Water		40mL vials with Teflon-lined cap	3	Cool, 40C	14 days (7 days if unpreserved)
TEPH	Soil	8015M	6-inch tube with Teflon-lined cap or 16-oz glass jar	1	Cool, 40C	14 days to extraction; additional 40 days to analysis
	Water		1-liter Amber glass bottle with Teflon-lined cap	2	Cool, 40C	7 days to extraction; additional 40 days to analysis
BTEX	Soil	8020	6-inch tube with Teflon-lined cap or 16-oz glass jar	1	Cool, 40C	14 days
	Water		40mL vials with Teflon-lined cap	3	HCl to pH<2, Cool, 40C	14 days (7 days if unpreserved)
Total Metals	Soil	CLP	6-inch tube with Teflon-lined cap or 16-oz glass jar	1	Cool, 40C	6 months
	Water		250 mL Polyethylene bottle	1	HNO <sub>3</sub> Cool, 40C	6 months

Notes:

CLP  
PAH  
TPPH  
TEPH

U.S. EPA Contract Laboratory Program  
Polynuclear aromatic hydrocarbon  
Total purgeable petroleum hydrocarbons  
Total extractable petroleum hydrocarbons

VOC  
HCl  
HNO<sub>3</sub>  
mL

Volatile organic compounds  
Hydrochloric acid  
Nitric acid  
milliliter

- The ice chest will be custody-sealed by placing a short length of custody tape across the opening of the ice chest lid at two places on the front and one on the side of the ice chest. The custody tape will then be signed and dated.
- An air bill will be prepared and affixed to the lid of the ice chest. The ice chest may then be handed over to the specified overnight carrier, such as Federal Express or United Parcel Service, for shipment.

No samples will be held on site for more than 24 hours, except when weekend sampling occurs. Samples collected on weekends will be refrigerated and shipped on the next available working day.

### **4.3 FIELD DOCUMENTATION**

Sampling activities during the field work require several forms of documentation to maintain sample identification, COC, and to record significant events or observations. Required documentation will include the use of logbooks and field change request forms.

#### **4.3.1 Logbooks**

Logbooks are hard-bound notebooks in which all activities associated with the field investigation will be thoroughly described. Logbooks are intended to provide sufficient data to reconstruct events occurring during the field project. A field sampling logbook will be kept by the TtEMI FTL. Information regarding sampling activities will be recorded within the field sampling logbook and will include, at a minimum, the following:

- Personnel on site
- Weather Conditions
- Sampling and shipping summary
  - Air bill number
  - COC number
  - Sample destination
  - Time of pickup
- Stop and start times for sampling activities at each location
- Description of any problems encountered during sampling at each location
- Description of deviations from the work plan

#### **4.3.2 Field Change Request Forms**

Field change request forms provide a written record documenting proposed changes to project plans including the work plan, the health and safety plan, and the QAPP. Any request will include the rationale for the proposed changes and the anticipated impacts of the deviation. The form will be signed by appropriate project personnel, including the TtEMI FTL, the TtEMI health and safety program officer, and the TtEMI project manager. Approval of the change by the Navy may be required before any change to the field program is implemented.

#### **4.4 LABORATORY DOCUMENTATION**

The laboratory will provide data packages in accordance with the TtEMI laboratory services SOW (PRC 1995).

The data package will include two copies of a summary data package containing the following:

- Case narrative
- Copies of non-conformance/corrective action forms
- Chain-of-custody forms
- Tracking documents
- Sample results
- QA/QC summaries

The data package will also include requirements for a full data package that includes the following:

- Sample raw data
- QC raw data
- Standard raw data
- Instrument raw data
- Other raw data

#### **4.5**

### **DATA VALIDATION AND QUALITY CONTROL SUMMARY REPORTS**

Data validation is the process by which the laboratory data package, or sample delivery group (SDG), is technically evaluated by a party independent of the laboratory.

The laboratory will analyze samples in SDGs that consist of no more than 20 samples each. The validation reviewer will prepare a validation narrative for each SDG. Each validation narrative will contain a list of the samples in the SDG, the analyses performed, the identity of the samples receiving full validation, and the results of validation for each methodology.

During data validation, the validation reviewer will complete worksheets that document the criteria reviewed. These worksheets will be used to generate the validation narrative. The worksheets are part of the complete data validation report that will be kept on file in TtEMI's Sacramento office.

Once the analytical data have been received from the laboratory and the data validation has been performed, a quality control summary report (QCSR) will be prepared. The QCSR summarizes the data validation reports, the project goals, the PARCC criteria, and evaluates the ability of the analytical data to support the project DQOs. The QCSR will include the following information:

- Tabulated, validated data tables
- Data validation narratives
- Evaluation of PARCC criteria

The QCSR is intended to provide a general overview of data quality and the data validation reports. Specific details may be found in the data validation narratives which are included in the appendix of the QCSR.

### **5.0 MEASUREMENT AND DATA ACQUISITION**

The following sections describe the field and laboratory methods and QA/QC requirements associated with sampling and analyses of soil and groundwater samples collected during the project.



## 5.1

### FIXED LABORATORY ANALYSES

Soil and groundwater samples sent to the fixed laboratory for analysis of VOCs and PAHs will be analyzed using EPA CLP methods according to the CLP SOW OLM03.1 protocol (EPA 1994b). In addition, because the CLP soil reporting limits for several PAHs are higher than their respective residential PRGs (EPA 1998), all soil samples reported as non-detected for benzo(a)pyrene and/or dibenz(ah)anthracene (which have the highest carcinogenic potentials and the lowest residential PRGs of the PAHs) will be reanalyzed using SW-846 Method 8310 (EPA 1986). SW-846 Method 8310 will provide detection limits below the PRGs for all PAHs.

Total petroleum hydrocarbons in soil and water samples will be analyzed in accordance with SW-846 Method 8015M modified for both purgeable (TPPH) and extractable (TEPH) petroleum hydrocarbons (EPA 1986 and SWRCB 1988). The calibration fuel for TPPH will be gasoline. The calibration fuel for TEPH will be diesel No.2 and motor oil. In accordance with the TtEMI laboratory services SOW (PRC 1995), the laboratory will appropriately flag any chromatographic patterns for samples not conforming to specific retention time windows or pattern recognition for the calibration fuels. BTEX in soil and water samples will be analyzed in accordance with SW-846 Method 8020 (EPA 1986).

Total metals in soil samples (GAP 9 at Site 14) will be analyzed in accordance with CLP SOW ILM04.0 protocol (EPA 1995).

Table A-4 presents the fixed laboratory analytical parameters and methods that will be used for the analysis of samples collected at Alameda Point. Appropriate QA requirements are listed for all analyses in Tables A-5 through A-8. CRQLs and CRDLs for CLP methods are presented in Tables A-9 and A-10. Quantitation limits for TPPH, TEPH, BTEX, and PAHs by SW-846 Method 8310 are presented in Table A-11. Quantitation limits for TEPH and VOC field methods are presented in Table A-12.

## 5.2

### GC/MS FIELD ANALYSIS

As described in Section 2.4 of the FSP, groundwater samples collected at Site 14 will be analyzed on site using a mobile laboratory. The mobile laboratory will employ a gas chromatograph/mass spectrometer (GC/MS) to perform a modified SW-846 Method 8260A for chlorinated and aromatic VOCs. The objective

**TABLE A-4**  
**FIXED LABORATORY**  
**ANALYTICAL PARAMETERS AND METHODS**  
**ALAMEDA POINT**

Parameter	Method
Volatile organic compounds	CLP SOW <sup>a</sup>
Semivolatile organic compounds (including polynuclear aromatic hydrocarbons)	CLP SOW <sup>a</sup>
Total Metals	CLP SOW <sup>b</sup>
Polynuclear aromatic hydrocarbons	8310 <sup>c</sup>
Total extractable petroleum hydrocarbons	8015-modified <sup>c,d</sup>
Total purgeable petroleum hydrocarbons	8015-modified <sup>c,d</sup>
BTEX	8020 <sup>c</sup>

**Notes:**

- a EPA CLP OLM03.1, August 1994
- b EPA CLP ILM04.0, 1995
- c SW-846 Test Methods for Evaluating Solid Waste, EPA, 3rd Edition, 1986
- d SWRCB "Leaking Underground Fuel Tank Field Manual," 1988

**TABLE A-5**  
**VOLATILE ORGANIC COMPOUNDS - CLP METHOD**  
**MATRIX SPIKE AND SURROGATE SPIKE RECOVERY LIMITS**  
**ALAMEDA POINT**

Matrix Spike Compound	Water		Soil	
	% Recovery	RPD	% Recovery	RPD
1,1-Dichloroethene	61-145	14	59-172	22
Trichloroethene	71-120	14	62-137	24
Chlorobenzene	75-130	13	60-133	21
Toluene	76-125	13	59-139	21
Benzene	76-127	11	66-142	21
System Monitoring Compound	Water		Soil	
	% Recovery		% Recovery	
Toluene-d8	88-110		84-138	
Bromofluorobenzene	86-115		59-113	
1,2-Dichloroethane-d4	76-114		70-121	

Note:

RPD    Relative Percent Difference

**TABLE A-6**  
**TOTAL METALS - CLP METHOD**  
**MATRIX SPIKE ACCURACY AND PRECISION LIMITS**  
**ALAMEDA POINT**

Matrix Spike Compound	Water		Soil	
	% Recovery	RPD	% Recovery	RPD
Metals (all)	75	25	75	35

TABLE A-7

**SEMIVOLATILE ORGANIC COMPOUNDS - CLP METHOD  
MATRIX SPIKE AND SURROGATE SPIKE RECOVERY LIMITS  
ALAMEDA POINT**

Matrix Spike Compound	Water		Soil	
	% Recovery	RPD	% Recovery	RPD
Phenol	12-110	42	26-90	35
2-Chlorophenol	27-123	40	25-102	50
1,4-dichlorobenzene	36-97	28	28-104	27
n-Nitroso-di-n-propylamine	41-116	38	41-126	38
1,2,4-Trichlorobenzene	39-98	28	38-107	23
4-Chloro-3-methylphenol	23-97	42	26-103	33
Acenaphthene	46-118	31	31-137	19
4-Nitrophenol	10-80	50	11-114	50
2,4-Dinitrotoluene	24-96	38	28-89	47
Pentachlorophenol	9-103	50	17-109	47
Pyrene	26-127	31	35-142	36
Surrogate Spike Compound	Water		Soil	
	% Recovery		% Recovery	
Nitrobenzene-d5	35-114		23-120	
2-Fluorobiphenyl	43-116		30-115	
Terphenyl-d14	33-141		18-137	
Phenol-d5	10-110		24-113	
2-Fluorophenol	21-100		25-121	
2,4,6-Tribromophenol	10-123		19-122	
2-Chlorophenol-d4	33-110		20-130	
1,2-Dichlorobenzene-d4	16-110		20-130	

Note:

RPD    Relative Percent Difference

TABLE A-8

**SW-846 METHOD  
ACCURACY AND PRECISION LIMITS  
ALAMEDA POINT**

Matrix Spike Analyte by Method	Water		Soil	
	% Recovery	RPD	% Recovery	RPD
Total Purgeable Petroleum Hydrocarbons-Gasoline by SW-846 8015M	70-130	30	70-130	30
Total Extractable Petroleum Hydrocarbons Motor Oil by SW-846 8015M	50-150	50	50-150	50
Benzene, Toluene, Ethyl Benzene, and total Xylenes, (all compounds) by SW-846 8020	70-130	30	70-130	30
PAHs (all compounds) by SW-846 8310	60-140	40	60-140	40
Surrogate Spike Compound	Water		Soil	
	% Recovery		% Recovery	
Surrogate Spike Compound-Gasoline	70-130		70-130	
Surrogate Spike Compound-Motor Oil	50-150		50-150	
PAHs-(laboratory specified compounds)	60-140		60-140	

Note:

RPD = Relative Percent Difference

PAH = Polynuclear Aromatic Hydrocarbon

TABLE A-9

**CLP CONTRACT REQUIRED QUANTITATION LIMITS  
ALAMEDA POINT**

Volatile Organic Compounds by CLP SOW		
Analyte	Water (µg/L)	Soil (µg/kg)
Chloromethane	2	10
Bromomethane	2	10
Vinyl chloride	0.5	10
Chloroethane	2	10
Methylene chloride	2	10
Acetone	2	10
Carbon disulfide	2	10
1,1-Dichloroethene	2	10
1,1-Dichloroethane	2	10
1,2-Dichloroethene	2	10
Chloroform	2	10
1,2-Dichloroethane	0.5	10
2-Butanone	2	10
1,1,1-Trichloroethane	2	10
Carbon tetrachloride	0.5	10
Bromodichloromethane	2	10
1,2-Dichloropropane	2	10
cis-1,3-Dichloropropene	2	10
Trichloroethene	2	10
Dibromochloromethane	2	10
1,1,2-Trichloroethane	2	10
Benzene	0.5	10
trans-1,3-Dichloropropene	0.5	10
Bromoform	2	10
4-Methyl-2-pentanone	2	10
2-Hexanone	2	10
Tetrachloroethene	2	10
Toluene	2	10
1,1,2,2-Tetrachloroethane	2	10
Chlorobenzene	2	10
Ethylbenzene	2	10
Styrene	2	10
Total xylenes	2	10

TABLE A-9 (continued)

**CLP CONTRACT REQUIRED QUANTITATION LIMITS  
ALAMEDA POINT**

Polynuclear Aromatic Hydrocarbons by CLP SOW		
Analyte	Water (µg/L)	Soil (µg/kg)
Naphthalene	10	330
2-Methylnaphthalene	10	330
Acenaphthylene	10	330
Acenaphthene	10	330
Fluorene	10	330
Phenanthrene	10	330
Anthracene	10	330
Fluoranthene	10	330
Pyrene	10	330
Benzo(a)anthracene	10	330
Chrysene	10	330
Benzo(b)fluoranthene	10	330
Benzo(k)fluoranthene	10	330
Benzo(a)pyrene	10	330
Indeno(1,2,3-cd)pyrene	10	330
Dibenzo(a,h)anthracene	10	330
Benzo(g,h,i)perylene	10	330

## Notes:

ug/L = microgram per liter  
 µg/kg = microgram per kilogram  
 CLP = Contract Laboratory Program  
 SOW = Statement of work

TABLE A-10

**CLP CONTRACT REQUIRED DETECTION LIMITS  
ALAMEDA POINT**

Metals by CLP SOW	
Analyte	Soil (mg/kg)
Aluminum	5
Antimony	2
Arsenic	2
Barium	40
Beryllium	1
Cadmium	1
Calcium	1,000
Chromium	2
Cobalt	10
Copper	1
Iron	20
Lead	1
Magnesium	1,000
Manganese	3
Mercury	0.1
Molybdenum	2
Nickel	2
Potassium	1,000
Selenium	1
Silver	1
Sodium	1,000
Thallium	1
Vanadium	10
Zinc	4

Notes:

mg/kg = microgram per kilogram  
 CLP = Contract Laboratory Program  
 SOW = Statement of work



TABLE A-11

**SW-846 METHOD QUANTITATION LIMITS  
ALAMEDA POINT**

<b>Polynuclear Aromatic Hydrocarbons by 8310</b>		
<b>Analyte</b>	<b>Water (µg/L)</b>	<b>Soil (µg/kg)</b>
Naphthalene	N/A	50
2-Methylnaphthalene	N/A	50
Acenaphthylene	N/A	50
Acenaphthene	N/A	50
Fluorene	N/A	50
Phenanthrene	N/A	50
Anthracene	N/A	5
Fluoranthene	N/A	50
Pyrene	N/A	5
Benzo(a)anthracene	N/A	5
Chrysene	N/A	5
Benzo(b)fluoranthene	N/A	5
Benzo(k)fluoranthene	N/A	5
Benzo(a)pyrene	N/A	5
Indeno(1,2,3-cd)pyrene	N/A	5
Dibenzo(a,h)anthracene	N/A	5
Benzo(g,h,i)perylene	N/A	5
<b>Total Petroleum Hydrocarbons by 8015M</b>		
<b>Analyte</b>	<b>Water (µg/L)</b>	<b>Soil (mg/kg)</b>
TPPH-Gasoline	50	0.5
TEPH-Diesel	200	10
TEPH-Motor Oil	500	20
BTEX	0.5	0.005

## Notes:

ug/L = microgram per liter

µg/kg = microgram per kilogram

N/A = not applicable

mg/kg = milligram per kilogram

CLP = Contract Laboratory Program

TABLE A-12

**FIELD METHOD QUANTITATION LIMITS  
ALAMEDA POINT**

Modified 8260A Field Analysis	
Analyte	Water (µg/L)
Tetrachloroethane	1.0
Trichloroethene	1.0
1,1,1-Trichloroethane	1.0
1,1-Dichloroethene	1.0
(total)-1,2-Dichloroethene	1.0
1,1-Dichloroethane	1.0
Vinyl chloride	1.0
Total Extractable Petroleum Hydrocarbons by 8015M Field Analysis	
Analyte	Water (mg/L)
TEPH-Diesel	1.0
TEPH-Motor Oil	2.0

## Notes:

ug/L = microgram per liter  
mg/L = milligram per liter

of the on-site laboratory is to provide screening level analytical data. Samples collected for field analysis by this method will be sent to a fixed laboratory for confirmation at a rate of fifteen percent, or a minimum of 15, which ever is greater.

The field laboratory will analyze the groundwater samples for the following compounds:

**Volatile Chlorinated Hydrocarbons:** Tetrachloroethene, trichloroethene, 1,1,1-trichloroethane, 1,1-dichloroethene, cis and trans-1,2-dichloroethene, 1,1,-dichloroethane, and vinyl chloride

**Total Extractable Petroleum Hydrocarbons:** TPH-Diesel and TPH-motor oil

Data quality objectives for this project require quantitative screening level analytical data. The data will be used as a screening tool to guide the investigation; however, due to the nature of the contaminants at Site 14, positive identification of the specified compounds is required. The screening level data will not be used for risk assessment purposes. The following section describes specific deviance's from the method that will simplify the field implementation of SW-846 Method 8260A.

**SW-846 Method 8260A with Purge and Trap Sample Preparation.** The Subcontractor will follow all procedures and QC criteria specified in SW-846 Method 8260A (EPA 1986) with the following exceptions:

1. For water samples, a three point calibration for all specified analytes is required at concentrations of 2 µg/L, 10 µg/L, and 100 µg/L (based on a 5.0 milliliter sample size). All analytes must have a relative standard deviation (RSD) of less than 50 percent for the average response factors (RF).
2. An initial calibration verification (ICV) standard prepared from a separate source is required at the mid-point concentration. All analytes must have a percent difference (%D) for the ICV RFs of less than 35 percent.
3. A one-time 0.5 µg/L sensitivity check standard containing all specified analytes is required prior to analyzing any samples. The laboratory must demonstrate the ability for the GC/MS system to identify and quantitate all compounds at this concentration. Recovery for all analytes should be between 30 - 150 percent. The laboratory will report this concentration as the detection limit (DL) for all analytes.
4. A continuing calibration check is required at the beginning and end of each 18 hour period of operation. All analytes must have a %D less than 50 percent. If the %D is greater than 50 percent for any compound, the laboratory will regenerate the calibration curve.

5. A bromofluorobenzene (BFB) performance check is required once per day prior to analyzing standards. The instrument must pass the BFB performance criteria with the following exceptions: (1) the spectra may be averaged over the whole BFB peak if necessary; (2) if the BFB tune criteria are not met, the TtEMI representative may determine that the deficiencies are not sufficient to hinder proper performance of the method and can instruct laboratory personnel to continue without further modification of the system.
6. Internal standard (IS) area counts and surrogate standard (SS) recoveries will be monitored for each analysis. Three IS compounds and three SS compounds are required. IS area counts for each analysis must be within 30 - 200 percent of the IS area counts for the continuing calibration standard. If IS recoveries are outside the 30 - 200 percent range, the system will be considered unstable and analysis will be discontinued until the problem is rectified. SS recoveries must be within 50 - 150 percent for each analysis unless recovery problems are attributed to matrix interference problems. SS recoveries outside of the 50 - 150 percent range will be evaluated by a TtEMI representative on a sample-by-sample basis.
7. One matrix spike is required for each 18 hour period of operation. The concentration of the matrix spike shall be 10 µg/L for water samples and will contain all specified analytes.
8. The laboratory will not be required to perform matrix duplicate analyses. The field sampling team leader will provide the laboratory with field duplicate samples for analysis. Table A-1 provides a list of designated samples.

### 5.3 QUALITY CONTROL REQUIREMENTS AND FREQUENCY

QC checks are instituted to obtain accurate and precise data and to document the quality of the data. These checks cover the field sampling effort and the laboratory analytical work. This section discusses the required QC checks and their frequency.

#### 5.3.1 Field Quality Control Samples

Field QC samples will be collected for field and fixed laboratory analysis to check sampling and analytical accuracy and precision. These samples are consistent with guidelines presented in the Navy QA requirements (Naval Energy and Environmental Support Activity 1988). Table A-10 summarizes all field and laboratory QC samples.

#### Field Blank Samples

Field blank samples consist of the source water used for the final rinsing of sampling equipment during decontamination. The water used will be deionized or distilled and will be obtained in 5-gallon plastic

**TABLE A-13**

**FIELD AND LABORATORY QC SAMPLES  
ALAMEDA POINT**

<b>Sample Type</b>	<b>Frequency of Collection</b>
Matrix Spike/Matrix Spike Duplicate Pair (soil and water samples)	5 percent <sup>a</sup>
Field Duplicate (water samples)	10 percent
Field Blank Sample	One sample collected per event
Equipment Rinsates	One rinsate collected per day per equipment

**Notes:**

- a At least one MS/MSD pair will be included with each analytical batch. The sample selected for the MS/MSD pair will be chosen by the field personnel and submitted to the laboratory in triplicate.

carboys from a reliable vendor. The field blank samples will be analyzed for all analyses in which a decontamination procedure was used. The results of the field blank samples will provide information on the potential for contamination of field samples and will be used to qualify data on the basis of blank contamination. One field blank sample will be collected during the soil sampling.

### **Equipment Rinsate Samples**

Equipment rinsate samples are used to evaluate the decontamination procedures and the resulting cleanliness of the sampling equipment. The rinsate samples will be collected after a sample collection device is subjected to standard decontamination procedures. Deionized or distilled source water will be poured over or through the sampling device after decontamination and will be collected in the appropriate containers for analysis. The equipment rinsate samples will be packaged with the field samples and shipped blind to the laboratory for the specified analyses. One equipment rinsate sample per sampling device per day will be sampled and submitted for the appropriate analyses.

### **5.3.2 Fixed Laboratory Quality Control Parameters**

Fixed laboratory QC samples and procedures will be performed at the frequency specified in the referenced method, and as required by the laboratory's specific QA/QC program. These QC samples and procedures may include the following:

- Method blanks
- MS/MSDs
- Matrix duplicates
- Laboratory control samples
- Interference check samples
- Post-digestion spike samples
- Instrument performance check samples
- Internal standards
- Surrogate standards

### **5.4 INSTRUMENT AND EQUIPMENT TESTING, INSPECTIONS, AND MAINTENANCE REQUIREMENTS**

The fixed laboratory will perform instrument and equipment testing, inspections, and maintenance at the frequency specified in the referenced method, and as required by the laboratory's specific QA/QC program.

#### **5.4.1 Instrument Calibration and Frequency**

For all analytical laboratory procedures, the analytical instruments must be calibrated within the method requirements specified in the laboratory's standard operating procedures and, in addition, the TtEMI SOW. All calibration information, including date and time, will be logged on the appropriate form, logbook, document, and electronic format. The analytical laboratories will perform and retain documentation of calibration and maintenance of all instruments used for the analysis of samples.

#### **5.4.2 Inspection and Acceptance Requirements for Supplies and Consumables**

Supplies and consumables to be used in the field will be ordered from Hazco, Inc., TtEMI's equipment supplier. Prior to use in the field, the items will be inspected and tested. Any defective material will be replaced prior to the onset of the sampling event.

All sample containers with the appropriate preservation are prepared by the analytical laboratory following laboratory procedures, and meet EPA specifications for certified clean containers. All containers and coolers are inspected prior to use for packing and shipping samples. Prior to use in the field, containers will be inspected. Any defective material will be replaced prior to the onset of the sampling event.

Appropriate materials (such as bubble-wrap, plastic bags, and tape) will be available for packing samples to avoid breakage during transportation.

### **5.5 DATA ACQUISITION REQUIREMENTS**

Data acquired through the analyses of samples will be reported following formats established by the CLP method and the TtEMI SOW, and will be reported within the required deliverable schedule. All data from analytical laboratories will be presented in a CLP hardcopy or equivalent data package and in the electronic data deliverable format detailed in the TtEMI SOW (PRC 1995).

The electronic data deliverable (EDD) is an ASCII file of the results and sample identification information downloaded into a specific file structure from the laboratory information management system. The EDD is imported into the Alameda Point database. All data and QC information in the file

must be within the limits established by the TtEMI SOW for correct transfer of the data from the laboratory. If an EDD is incorrectly structured, the laboratory is required to resubmit the data file.

All field data will be recorded on the appropriate field forms for data entry into the Alameda Point database. All data entered into the database, either from field forms or imported from an EDD, will be reviewed for accuracy.

## **5.6 DATA MANAGEMENT**

The following sections outline the project data management scheme.

### **5.6.1 Field Data Management**

The TtEMI project manager will be responsible for the review, transfer, and storage of all data collected in the field for the Sites 14 and 25 investigations. Field activities will be documented by the TtEMI FTL as described in Section 4.0. All field change request forms and daily field sampling reports will be filed by the TtEMI project manager and copies will be included as an appendix to the final QCSR.

### **5.6.2 Laboratory Data Management**

Upon the receipt of the samples by the laboratory, the laboratory sample custodian will reconcile the information on the COC forms with the sample bottles received. The sample custodian will document any anomalies and report these to the laboratory project manager. Anomalies will be resolved with the TtEMI project chemist. The information on the COC forms will then be entered into the laboratory's information management system along with the analyses being requested. The proper sample container labels will be generated and attached to the containers.

Data acquired through the sample preparation, analysis, and reporting processes are tracked using the laboratory's information management system. Data are either transferred from the instrumentation electronically to the laboratory's information management system or qualified personnel enter the data through terminals. The laboratory is responsible for tracking all QC measurements along with the specific sample results on a batch basis. Any QC measurements that exceed the specified QC limits for the project are documented. QC problems which directly impact data quality are immediately



communicated to the TtEMI project chemist. The laboratory will implement necessary corrective action which also will be appropriately documented. After all data are collected, reviewed, and approved, the laboratory will generate an EDD and a CLP data package from the laboratory's information management system and deliver them to the TtEMI project chemist.

The laboratory project manager is responsible for proper sample handling and documentation that will allow for the tracking of individual samples from the time of receipt to the submittal of the final data package and electronic deliverable to the TtEMI project chemist. Laboratory sample receipt deficiency reports and non-conformance memos will be used by the laboratory to document and disseminate non-conformance information to the TtEMI project chemist.

The laboratory is required to maintain the analytical records for a period of 10 years. Data can be stored in a number of ways, usually including a combination of hard copy and computer tape backups.

### **5.6.3 TtEMI Data Management**

The laboratory is responsible for sending a hard copy of the CLP data package and an EDD on computer diskette to the TtEMI project chemist. Upon the receipt of the data package, the EDD is imported into TtEMI's database. The importing program checks the format and content of the EDD for compliance with TtEMI specifications. Any errors reported by the importing program are thoroughly investigated. If necessary, the laboratory is requested to regenerate the deliverable. The EDD, as well as the hard copy data package, are also checked for completeness. Any missing information in either the EDD or the hard copy is immediately requested from the laboratory.

Data tables are printed from the database and copies of both the data tables and the hard copy data package are sent to an outside party for data validation as described in Section 6.4. The validator then applies qualifiers or comment codes, as appropriate, to data and marks the data tables for input into the database. The validator prepares a data validation report and returns the data package, marked tables, and data validation report to the TtEMI project chemist.

The TtEMI project chemist performs a technical review of the data validation report as described in Section 6.1.3. The data tables are submitted to a data entry person for input into the database. The final version of the data validation report is generated complete with the analytical tables containing the

appropriate qualifiers and comment codes. This complete data validation package is stored with the raw analytical data. Copies of all validation report narratives are submitted with the QCSR.

The TtEMI project chemist is responsible for the proper handling of the data. At the conclusion of the project, the TtEMI project chemist will prepare a QCSR in support of the report which summarizes the overall quality of the data and also determines whether the DQOs were achieved. All hard copy data packages are stored in an off-site storage facility and the final versions of the electronic data tables are archived onto electronic data diskettes for permanent storage.

## **6.0 ASSESSMENT AND OVERSIGHT**

An assessment evaluates the capability and performance of a measurement system or its components and identifies problems warranting correction. This section presents the activities for assessing the effectiveness of the implementation of the QAPP.

### **6.1 ASSESSMENT**

Assessments planned for the Sites 14 and 25 investigations include the following: (1) performance evaluations, (2) technical systems audits, (3) technical reviews, and (4) field audits.

#### **6.1.1 Performance Evaluations**

A performance evaluation includes a review of the existing project and QC data to determine the accuracy of a total measurement system or a component of the system. Laboratory performance evaluations are conducted routinely by the Navy and TtEMI. Internal performance evaluations or audits for the laboratory are described in the laboratory QA plan.

#### **6.1.2 Technical Systems Audit**

A technical systems audit is used to verify adherence to QA policies and standard operating procedures. This type of audit may consist of an on-site review of measurement systems, including facilities, equipment, and personnel. Additionally, procedures for measurement, QC, and documentation may be evaluated. Technical systems audits are scheduled at the program rather than the project level. The QA

Program Manager is notified of project activities such that the project may be selected for a technical systems audit.

#### **6.1.3 Technical Reviews**

Technical reviews are performed on all reports and deliverables, including data validation reports and the QCSR. All data validation reports are reviewed for technical accuracy by a chemist independent from the data validator. The data validation reports are reviewed for consistency within the project as well as the overall remedial investigation.

#### **6.1.4 Field Audits**

A field audit involves an on-site visit by the auditor or auditing team. Items to be examined include the availability and implementation of approved work procedures; performance of field laboratories, calibration and operation of field equipment; packaging, storage, and shipping of samples; documentation of procedures and instructions; and non-conformance documentation. Field audits are scheduled at the program rather than the project level. The QA Program Manager is notified of project activities such that the project may be selected for an field audit.

### **6.2 RESPONSE ACTION**

An effective QA program requires prompt and thorough correction of non-conformances affecting quality. Rapid and effective corrective action minimizes the possibility of questionable data or documentation. All QA problems and corrective actions will be documented to provide a complete record of QA activities.

#### **6.2.1 Field Corrective Action Procedures**

Corrective action procedures will depend on the severity of the non-conformance. In cases where immediate and complete corrective action may be implemented by field personnel, corrective actions will be recorded in the field logbook and summarized in the daily field progress report and site logbook.

Non-conformances identified during an audit that have a substantial impact on data quality require the completion of a corrective action memorandum. This memorandum may be completed by an auditor or any individual who suspects that any aspect of data integrity is being affected by a field non-conformance. The memorandum will include the description of the problem and the required corrective action.

Copies of the corrective action memo will be distributed to the project manager, FTL, the project QA officer, and the project file. The project QA officer will forward the memorandum to the CLEAN II program manager and the QA program manager as appropriate. Key personnel will meet to discuss the following:

- Determine when and how the problem developed
- Assign responsibility for problem investigation and documentation
- Determine the corrective action needed to eliminate the problem
- Design a schedule for completion of the corrective action
- Assign responsibility for implementing the corrective action
- Document and verify that the corrective action has eliminated the problem

The person identified as responsible for implementing the corrective action will also be responsible for completing a follow-up memorandum documenting the completion of the corrective action. The follow-up memorandum will be submitted to the project QA officer to evaluate that the solution has adequately and permanently corrected the problem. The QA program manager can require data acquisition to be limited or discontinued until the corrective action is complete and the non-conformance eliminated. The QA program manager can also request the reanalysis of any or all data acquired since the system was last in control.

### **6.2.2 Laboratory Corrective Action Procedures**

The internal laboratory corrective action procedures and a description of out-of-control situations requiring corrective action are contained in the laboratory QA plan. At a minimum, corrective action will be implemented when control chart warning or control limits are exceeded, method QC requirements are not met, or sample holding times are exceeded. Out-of-control situations will be reported to the project chemist within 2 working days of identification. In addition, a corrective action

report, signed by the laboratory director or project managers and the laboratory QC coordinator, will be provided to the project chemist. The corrective action report will include the description of the problem, the identification of affected samples, and the required corrective action.

The corrective action procedures require that the laboratory identify all out-of-control situations that would result in significant amounts of qualified data and perform a corrective action designed to reduce the amount of qualified data. This corrective action is often the reanalysis of samples once the cause of the out-of-control situation has been identified and corrected.

### **6.3            REPORTS TO MANAGEMENT**

A summary progress report will be prepared on a monthly basis by the project manager and submitted to the Navy. The report may include the following:

- Audit results, if any audit conducted during the reporting period
- Status of the project
- Problems affecting QA and recommended solutions
- Objectives from the previous report that were achieved
- Objectives from the previous report that were not achieved
- Work and objectives planned for the next month

This information will also be required from any subcontractors and will be included in the monthly status report.

### **6.4            DATA VALIDATION AND USABILITY**

This section provides an overview of the data validation process and how data usability will be documented. The data validation process ultimately enables reconciliation of the data with the project objectives.

#### **6.4.1           Data Review, Validation, and Verification Requirements**

Data validation is the process by which the laboratory data package, or SDG, is technically evaluated by a party independent of the laboratory. Through the data validation process, the data will be evaluated for

acceptable quality and quantity, based on the critical indicator parameters of PARCC (EPA 1987a). Analytical methods for each SDG will be validated on the basis of the criteria listed in the following:

- "U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review" (EPA 1994d)
- "U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (EPA 1994e)

During data validation, the validation reviewer will complete worksheets that document the criteria reviewed. These worksheets will be used to generate the validation narrative. Each validation narrative will contain a list of the samples in the SDG, the analyses performed, the identity of the samples receiving full validation, and the results of validation for each methodology. The worksheets and the narrative are part of the complete data validation report that will be kept on file in TtEMI's Sacramento office.

Samples in each SDG will receive a cursory validation review and, initially, 10 percent of the samples for each of the analyses performed will receive a full validation review. Table 11 lists the cursory validation criteria and the full validation criteria. During the cursory and full validation, if systematic errors are detected or review suggests thorough investigation is necessary, then additional data may be designated for full validation review. Therefore, it is anticipated that greater than 10 percent of the data will ultimately receive full validation.

After the data have been reviewed, data validation qualifiers will be applied to the analytical results. Data validation qualifiers are alphabetical characters that are placed next to each reported value that correspond to QC issues that may have affected the analytical results. Table 12 lists data validation qualifiers and their definitions based on functional guidelines (EPA 1994d).

The data validation summary will include a brief description of the results of the data validation process for each analytical method; this description consists of the assessment of data quality in terms of the

**TABLE A-14**  
**DATA VALIDATION EVALUATION CRITERIA**  
**ALAMEDA POINT**

<u>CLP Organics (EPA 1994c)</u>
*Holding times
GC/MS tuning
*Calibration (initial and continuing)
*Blanks (method, instrument, and preparation blanks)
*Surrogate recovery
*MS/MSD
*Field duplicates
*Internal standard performance
Target compound identification
Tentatively identified compounds
System performance
*Overall assessment of data for an SDG

Note: All items listed are evaluated during a full validation review.  
Cursory review items are indicated by a single asterisk (\*).

**TABLE A-15**  
**DATA VALIDATION QUALIFIERS**  
**ALAMEDA POINT**

<b>Data Qualifiers<sup>a</sup></b>	<b>Definition</b>
U	Compound was analyzed for, but was not detected above the concentration listed; the value listed is the sample quantitation limit.
J	Estimated concentration value; the result is considered qualitatively acceptable but quantitatively unreliable.
UJ	Estimated quantitation limit; the compound was analyzed for but was considered nondetected.
JN	An analyte has been tentatively identified; the associated numerical value represents its approximate concentration.
R	The data are unusable (compound may or may not be present). Resampling and reanalysis are necessary for verification.
No qualifier	The data are acceptable qualitatively and quantitatively.

Note:      <sup>a</sup> EPA 1994c

PARCC criteria. The details of the data validation process for each SDG, along with the validated analytical results, will be included as data validation narratives in an appendix of the QCSR.

The laboratory will submit analytical reports in hard copy and electronic formats. All analytical reports will be submitted with laboratory qualifiers that are defined by either the relevant EPA CLP SOW or the laboratory SOPs. Data submitted with CLP or laboratory-defined qualifiers will identify items such as (1) nondetected values, (2) values below the CRQL (considered estimated values), and (3) values with problems during the analysis. Through data validation, these CLP or laboratory-defined data qualifiers will be evaluated for appropriateness and replaced, as necessary, by the functional guidelines data validation qualifiers listed in Table 12 to notify the data user of the validity of the data. A database program created at TtEMI will be used to transfer data from the laboratory by an ASCII-formatted diskette. This database will allow (1) the data validation qualifiers to be substituted as necessary for the original laboratory qualifiers, (2) correction of detected data errors, (3) other software to be interfaced, and (4) tables to be printed with the validated results in various formats.

In addition to the analytical results with associated qualifiers, the printed tables will also include a comment column. The comment column is used to provide an explanation for any assigned qualifiers. The alphabetical letters "a" through "h" are used in the comment column and are comment codes which reference different QC issues that may have affected the analytical results. Table 13 lists the associated definitions for these comment codes. The comment codes on the analytical tables will provide the reader with an immediate explanation for the qualifier attached to the result. The comment code will also enable the reader to locate a detailed discussion of the QC issue in the appropriate data validation narrative.

#### **6.4.2 Reconciliation with Data Quality Objectives**

The TtEMI Project Chemist is responsible for data quality. Data quality issues concerning field sampling efforts, laboratory analysis, data validation, database management, and data reporting will be referred to the TtEMI Project Chemist. In addition, the TtEMI Project Chemist will be responsible for the following data handling procedures:

- Sorting, binding, and tracking analytical raw data delivered from the laboratory
- Input of EDD into the TtEMI database and printing initial result tables



**TABLE A-16**  
**DATA VALIDATION COMMENT CODES**  
**ALAMEDA POINT**

<b>TtEMI Comment Codes</b>	<b>Definition</b>
<b>a</b>	Surrogate spike recovery problems
<b>b</b>	Blank contamination problems
<b>c</b>	MS recovery problems
<b>d</b>	Duplicate (precision) problems
<b>e</b>	Internal standard problems
<b>f</b>	Calibration problems
<b>g</b>	Quantification below the reporting limit
<b>h</b>	Other problems; refer to data validation narrative

- Reconciling sample numbers, field identification numbers, and requested analyses based on the SAP, chain-of-custody, and data package
- Preparing and shipping SDGs to data validation services
- Performing technical review of the data validation reports
- Inputting data validation qualifiers into the TtEMI database
- Preparing final data validation report including text, supporting documentation, and final result tables
- Preparing EDD for input into geographical information system

After all of the analytical data have been received from the laboratory and the data validation has been performed, the TtEMI Project Chemist will prepare a QCSR. The QCSR will include the following information:

- Tabulated, validated data tables
- Data validation narratives
- Evaluation of PARCC criteria
- Field screening data summary
- Limitations on the applicability of the data
- Any quality assurance plan modifications from the work plan
- Field audit report
- Any corrective actions performed

The QCSR is intended to provide a general overview of data quality for the project. The QCSR will summarize the results of the data validation process, the project goals, the PARCC criteria, and will provide an evaluation of the ability of the analytical data to support the project DQOs. The data validation narratives, which document specific details of the validation process, will be included in an appendix to the QCSR.

## REFERENCES

- California State Water Resources Control Board. 1988. "Leaking Underground Fuel Tank (LUFT) Field Manual." Prepared by the State of California LUFT Task Force. May.
- PRC Environmental Management, Inc. (PRC) and Montgomery Watson. 1993. "Remedial Investigation/ Feasibility Study Work Plan Addendum, Draft, Naval Air Station Alameda, Alameda, California." September.
- PRC. 1995. "Navy CLEAN II Laboratory Services Statement of Work." June.
- Naval Energy and Environmental Support Activity. 1988. "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Restoration Program." Prepared by Martin Marietta Energy Systems, Inc. Second Revision. June.
- Tetra Tech EM Inc. 1998. "Draft Site 14 Groundwater Investigation and Site 25 Remedial Investigation Field Sampling Plan, Alameda Point, Alameda, California." August.
- U.S. Environmental Protection Agency (EPA). 1986. "Test Methods for Evaluating Solid Waste, 3rd Edition." SW-846. Office of Solid Waste and Emergency Response. Reference includes all promulgated revisions through 1996.
- EPA. 1987a. "Data Quality Objectives for Remedial Response Activities Development Process." Office of Emergency Response and the Office of Waste Programs Enforcement. March.
- EPA. 1987b. "A Compendium of Superfund Field Operations Methods." Office of Emergency and Remedial Response. December.
- EPA. 1993. "Data Quality Objectives Process for Superfund Interim Final Guidance." September.
- EPA. 1994a. "EPA Requirements For Quality Assurance Project Plans For Environmental Data Operations." EPA QA/R-5, Interim Final. May.
- EPA. 1994b. "Contract Laboratory Program (CLP) Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration." Document Number OLM03.1. August.
- EPA. 1995. "CLP SOW for Inorganic Analysis, Multi-Media, Multi-Concentration." Document Number ILM04.0.
- EPA. 1994c. "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review." February.

**APPENDIX B**

**METALS BACKGROUND COMPARISON**

## METALS BACKGROUND COMPARISON

Chemical All concentrations in ug/L	Background Minimum Detected Concentration	Background Maximum Detected Concentration	Background Mean Concentration	Background 95UCL Concentration	Background 80LCL/95 Concentration	Site 14 Range of Detected Concentrations	Site 14 > Background?	Alameda Annex Maximum Detected Concentrations*
Aluminum	3	3970	32.12	96.2	439.13	ND		605
Antimony	2.5	47.8	5.83	11.8	45.77	ND		14.4
Arsenic	2	40.7	4.54	8.0	28.39	ND		35.5
Barium	2.3	1260	34.06	123.3	574.73	29.5-83.7	No	1920
Beryllium	0.94	3.0	0.49	1.0	3.83	ND		1.3
Cadmium	0.32	6.5	0.53	1.3	5.38	ND		4
Calcium	.620	513000	17865.02	78223.0	379268.62	47500-110000	No	717000
Hexavalent Chromium-n	4.0	4.0	34.70	100.6	NA	ND		N/A
Chromium	0.74	82.8	1.54	3.4	13.79	ND		10.2
Cobalt	2.5	10.5	3.50	4.6	11.57	ND		19.2
Copper	2.1	27.3	3.97	7.5	27.48	ND		41.3
Iron	7.2	24400	108.58	1623.5	7134.52	810-2340	No	224000
Lead	1.2	28.4	0.91	1.3	3.88	ND		14.2
Magnesium	549	1070000	15091.70	103357.7	500168.34	26800-69000	No	1710000
Manganese	1.1	2480	86.01	1171.1	5212.94	453-1100	No	16400
Mercury-n	0.2	0.3	0.10	0.10	0.15	ND		2.4
Molybdenum	3.1	19.4	4.59	5.6	11.52	ND		21.1
Nickel	2.7	151.0	5.60	7.4	19.06	ND		57.5
Potassium	1200	505000	14314.10	40552.2	182152.59	23200-26300	No	833000
Selenium-n	2.5	2.5	1.58	1.9	5.97	ND		8.5
Silver-n	2.4	4.8	1.48	1.6	3.33	ND		11.3
Sodium	4600	8160000	198988.04	937369.5	4539829.44	246000-480000	No	15500000
Thallium-n	3.6	5.2	2.21	2.3	5.80	ND		10.4
Vanadium	2.0	50.8	4.97	8.4	28.65	ND		38.8
Zinc	2.8	46800	4.87	10.5	42.91	ND		144

Chemicals denoted "-n" display summary statistics based on a normal distribution; these chemicals had too few detections to determine probability distribution.

ND = Not Detected

Site 14 data presented are results for total metals analyses. Dissolved metal analyses were also performed.

\*Annex data presented are results for total and dissolved analyses for all wells over 9 quarters of monitoring.

**APPENDIX C**

**STANDARD OPERATING PROCEDURE 020**

**SOP APPROVAL FORM**

**PRC ENVIRONMENTAL MANAGEMENT, INC.**

**STANDARD OPERATING PROCEDURE**

**WELL INSTALLATION**

**SOP NO. 020**

**REVISION NO. 2**

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**Title: Well Installation**

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## **1.0 BACKGROUND**

Well type, well construction, and well installation methods will vary with drilling method, well utility, subsurface characteristics, or other site-specific criteria. Specifications for well installation will be identified within a site work plan, sampling plan, or Quality Assurance Project Plan (QAPjP). A Monitoring Well Installation Record (see Attachment A) will be completed for each well installed by PRC. This standard operating procedure (SOP) discusses general types of wells and minimum standards for well installation for PRC Environmental Management, Inc. (PRC) projects.

Specific boring protocols are detailed in individual SOPs. Well installation methods will depend somewhat on the boring method. In turn, the boring method will depend on site-specific geology and hydrogeology. Boring methods include:

- hollow-stem auger
- cable tool
- rotary (mud, reverse, or air)
- rock coring
- jetting

The hollow-stem auger method is preferred in areas where subsurface materials are unconsolidated or loosely consolidated and the depth of the boring will be generally less than 100 feet. This maximum depth is dependent on the diameter of the augers, the formation characteristics, and the strength and durability of the drilling equipment. This method is preferred because it is quick and inexpensive, addition of water into the subsurface is limited, and continuous samples can easily be collected.

Cable tool drilling is a preferred method when the subsurface contains boulders, coarse gravels, or flowing sands, or when the operational depth of the hollow-stem auger is exceeded. This method, however, is slow.



**Title: Well Installation**

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Rotary methods are generally used when other methods cannot be used. The use of drilling fluids, or large amounts of water to maintain an open borehole, and the difficulty in obtaining representative samples limit this method's utility. However, this method can be used to quickly and effectively drill deep wells through consolidated or unconsolidated materials. Modifications of this method such as dual-tube drilling, drill through casing hammers, or eccentric type drill system can reduce the amount of fluids introduced into the well borehole.

Rock coring is an effective method when drilling in competent consolidated rock. Intact, continuous cores can be obtained, and limited amounts of fluid are required if the formations are not fractured.

### **1.3 DEFINITIONS**

None.

### **1.4 REFERENCES**

California Department of Water Resources. 1981. "Water Well Standards: State of California." Bulletin 74-81. December

California Department of Water Resources. 1991. "California Well Standards, Supplement to Bulletin 74-81." Bulletin 74-90. June

Driscoll, Fletcher G., 1986. Ground-Water and Wells, 2nd. Edition. Johnson Division, St. Paul, Minnesota, p. 438-442.

National Well Water Association (NWWA), 1989. Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells. NWWA, p. 145-246.

### **1.5 REQUIREMENTS AND RESOURCES**

- Monitoring Well

**Title: Well Installation**

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## **2.0 PROCEDURES**

This section details the minimum general monitoring well installation criteria and procedures. Site-specific geologic regimes may result in departures from this procedure. Specific procedures should be detailed in a sampling plan, work plan, or QAPjP. Figure 1 shows the typical completed general monitoring well.

All wells will be equipped with factory slotted screen. Casings and screens should be threaded and flush coupled and watertight joints should be used. Casings and screens will be selected in accordance with criteria set forth in Section 2.1. Annular seals are described in Sections 2.2 and 2.3. General monitoring well installation should follow these steps:

- 1) Prior to the installation of any casing or screen into the borehole the material should be decontaminated. PRC SOP No. 002 explains decontamination rationale and procedures.
- 2) Well casing and screens should be anchored within the borehole using centralizers.
- 3) The filter pack and other annular sealing materials should be installed through the auger stem or borehole casing. A tremie pipe should be used to install this material and a weighted tape should be used to tamp material. The tremie pipe is slowly raised as material is added to the annular space. When wells are constructed in temporary casing such as hollow stem augers the augers should be lifted when 1 to 2 feet of construction material has accumulated in the annulus. The casing should be lifted enough so that the accumulated material settles to within 2 to 4 inches of the bottom of the temporary casing.
- 4) Screens will be placed within a filter pack. This filter pack will be constructed in the manner detailed in Section 2.2 and will extend a minimum of 2 feet above and 2 feet below the screened interval.
- 5) A fine sand collar should be installed to 2 feet above the top of the filter pack.
- 6) A minimum 2-foot thick bentonite slurry seal will be placed above the filter pack.

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- 7) A bentonite cement slurry should be pumped through a tremie pipe into the annular space up to a point approximately 2-feet below the ground surface.
- 8) A protective outer casing and locking cap should then be placed in the borehole and a cement surface seal should be installed. The cement surface seal will form a pad around the monitoring well.

## **2.1 CASINGS AND SCREENS**

The following procedure should be followed in selecting casings and screens.

The selection of well casing and screen materials must take into account environmental factors such as:

1) geologic environment, 2) natural geochemical environment, 3) anticipated well depth, and 4) types and concentrations of known or suspected contaminants. Other non-environmental factors that will impact on the material selection include: 1) anticipated life of the monitoring well, 2) drilling and installation methods, 3) cost, and 4) availability.

Inner casings and well screens should be constructed of inert, durable materials. Two preferred types of casing are stainless steel and polytetrafluoride (Teflon). Epoxy-fiberglass and polyvinyl chloride (PVC) casing and screen are sound well construction materials in many sampling environments. Epoxy-fiberglass well construction materials are relatively new to the environmental monitoring field, however, preliminary data suggests they are comparable to stainless steel but approximately half the cost. Due to the recent introduction of this material into the groundwater monitoring field local regulatory authorities should be consulted prior to the use of this material. Several states, EPA regions, and Army Corps of Engineers Districts are using this material as an alternative to stainless steel. PVC may be used if the contaminants of interest do not react with PVC or the well life is expected to be short.

Casing and screen joints should be threaded, and Teflon tape should be used to assure a tight seal with Teflon or stainless steel components. Epoxy-fiberglass and PVC joints typically are fitted with rubber

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O-rings to provide a tight seal. Teflon tape may also be applied to these joints to assure a prolonged tight seal. Under no circumstances should joints be glued or solvent sealed.

Screens will be factory-slotted. The screen slot size will be dependent on the required flow rates for the well and the texture of the formation. When sieve analysis information is available for well packing material, slot sizes should be capable of retaining 90 percent of the filter pack material (see Section 2.2). When no such information is available a default screen size of 0.01-inches (No. 10 slot) will be used.

Screen length and well diameter will depend on site-specific considerations. These include intended well use, contaminants of concern, and hydrogeology. Some considerations are as follows:

- Water table wells should have screens of sufficient length and thickness to monitor the water table and provide sufficient sample volume during high and low water table conditions.
- Wells with low recharge should have screens of sufficient length and width so that adequate sample volume can be collected.
- Wells should be screened over short enough distances to allow for monitoring of discrete migration pathways.
- Where light non-aqueous phase liquids (LNAPLs) or contamination in the upper portion of a hydraulic unit are being monitored, the screen should be set so that the upper portion of the water-bearing zone is below the top of the screen.
- Where dense non-aqueous phase liquids (DNAPLs) are being monitored, the screen should be set within the lower portion of the water bearing zone, just above a relatively impermeable lithologic unit.
- The screened interval should not extend across an aquiclude or aquitard.
- If contamination is known to be present and concentrated within a portion of a saturated zone, the screen should be constructed in a manner that minimizes the potential for cross contamination within the aquifer.

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- If downhole geophysical surveys are to be conducted the casing and screen material must be of sufficient diameter and constructed of the appropriate material to allow effective use of the geophysical survey tools.
- If aquifer tests are to be conducted in a monitoring well, the slot size must allow sufficient flux to produce the required drawdown and recovery. The diameter of the well must be sufficient to house the pump and or monitoring equipment, and allow sufficient water flux (in combination with the screen slot size) to produce the required drawdown or recovery.

In many instances it may be necessary to isolate stratigraphically higher portions of the subsurface, during drilling, from the zone being monitored. In these cases special types of drilling may be necessary. An example of this is the use of temporary or permanent borehole casing that is telescoped to smaller diameters with depth. With this approach, a large diameter casing is installed through the zone to be isolated and drilling is continued to depth through this casing. If necessary additional smaller diameter casing can be installed to stabilize the formation or isolate progressively deeper stratigraphic units. Another alternative involves the drilling of a large diameter borehole to the base of the zone to be isolated. This borehole is then sealed with a cement-bentonite grout. When the grout has cured the well installation borehole is drilled through the grout down to its final completion depth. Just as with the casing approach described above progressively deeper units can be isolated by the grouting of the portion of the borehole which penetrates then advancing the borehole through the hardened grout.

Prior to installing the casing and screen they should be fitted with centralizers to assure a uniform thickness of the annular seals. The annular seal is composed of the filter pack, sand collar, bentonite seal, and cement-bentonite grout. The annular seal should have a uniform thickness around the casing and screen of between two to four inches. Thinner seals increase the possibility that the well screen may be exposed to the formation, and thicker seals may interfere with the aquifer hydraulics around the screen. The selection of the centralizer material should be based on the same criteria used to select the casing and screen material. The centralizers should be spaced at closer intervals for smaller diameter casing and screen. Two-inch casing and screen should have centralizers installed every ten to fifteen feet.

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## **2.2 FILTER PACK**

The filter pack will be composed of chemically inert, uncontaminated material. The preferred filter pack material is pure silica sand.

The methods for choosing the filter pack grain size should be clearly outlined in the work plan, sampling plan, or QAPjP. The filter pack material must be tailored to the formation material. One method for choosing the filter pack grain size is based on the method proposed by NWWA (1989). Using this method, at least one standard sieve analysis of formation material is obtained. The grain size that retains 70 percent of the material is noted. This grain size is multiplied by a factor of 4 or 6. The factor of 4 is used for coarse poorly sorted formations, and the factor 6 is used for fine grained well sorted formations. The resultant grain size is used as the 70 percent retained point for the grain size of the filter pack. A second more conservative approach is described by Driscoll (1986). In this approach, the filter pack size is based on multiplying the 50 percent retained formation grain size by 2. If formation particle size distribution information is not available, an Ottawa grade sand, ASTM C-778 sand, or equivalent can be considered for use. The use of a default size filter pack becomes more tenuous in increasingly finer grained formations. The uniformity coefficient of the filter pack should not exceed 2.5. The filter pack should have a finished uniform thickness of 2 to 4-inches.

The filter pack should extend 2 feet above the top of the well screen. A sand collar should be installed on top of the filter pack. The sand collar should be constructed from a fine silica sand (.0021 to .0041 inch-diameter) and is should extend 2 feet above the filter pack. This sand collar is intended to prevent intrusion of bentonite and grout into the filter pack.

## **2.3 GROUT AND CEMENT**

A bentonite slurry should be placed in the annular pack for a minimum of 2 feet above the fine sand collar. This slurry should be mixed at a ratio of approximately 22-pounds of dry bentonite to 7-gallons of water. This should result in a 10 to 11-pound/gallon slurry. The bentonite slurry will act as a

**Title: Well Installation**

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formation seal for the monitoring well borehole. A cement and bentonite grout slurry will be placed in the annular space above the bentonite slurry, generally to a point approximately 2 feet below ground surface. Sufficient time should be allowed for the bentonite slurry to gel to a strength able to support the cement and bentonite grout. When mixing the slurry with a low shear device such as the grout pump or a drill rig, 30 to 60 minutes of mixing should be conducted prior to placing the slurry into the well annulus. After 30 to 60 minutes of low shear mixing the slurry should be thick enough to support the cement-bentonite grout. The cement and bentonite grout will consist of mixture of 8-gallons of water, 5-pounds of bentonite powder, and a 94-pound sack of Portland cement. An alternative cement-bentonite grout would be a premixed commercially equivalent material. A cement surface seal will be placed at the surface. Specific construction criteria may vary. These should be detailed in the work plan or QAPjP.

The bentonite slurry used as a formation seal above the filter pack and sand collar can be replaced with a seal composed of bentonite pellets or chips. These materials should be added to the annulus slowly to prevent bridging. Lifts of 3 to 4 inches should be separated by sufficient time to allow settlement. Past experience has shown that natural bentonite chips have slower hydration characteristics and are not as prone to bridging as formed bentonite pellets.

Bentonite seals are not always appropriate. If they are installed in the vadose zone they may never fully hydrate or they can dry creating desiccation cracks. Both situations cause seal failure. Groundwater with high chloride concentrations or total dissolved solids > 500 ppm may inhibit the full hydration of the bentonite. This could limit the effectiveness of the annular seal. The case of bentonite in areas where the seal may be exposed to high concentrations of organic solvents, hydrocarbons, organic acids, basic and natural polar-organic compounds, and neutral non-polar organic compounds may result in a several order-of-magnitude increase in the permeability of the seal. Neat cement is an alternative to bentonite seals given any of the above environmental conditions. Neat cement is a mixture of Portland cement (ASTM C-150) and water in the ratio of 5 to 6 gallons of water to 94 lbs. of cement. Type I Portland cement is the most commonly used material for this application.

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**Title: Well Installation**

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## **2.4 OTHER COMPONENTS**

The procedures below should be followed under specific circumstances.

Several other well components which may be necessary depending of project specifications are listed below:

- Locking well caps and outer protective casings. These will be placed on all completed wells. These can either be above ground or flush mount.
- Bumper posts or well head protection. Protective bumper posts or other types of protective barriers should be placed around each completed well.
- Grout baskets. Grout baskets may be necessary when drilling proceeds through voids or open spaces (such as underground mines).
- Telescoping or conductor casing. Telescoping or conductor casing is used when wells are drilled to fairly deep depths when drilling proceeds through several separate saturated intervals, or when drilling through grossly contaminated intervals.

## **3.0 OTHER TYPES OF WELLS**

This section discusses other types of wells which may be installed in special cases. These include well points, wells installed through multiple saturated zones, and well nests.

### **3.1 WELL POINTS**

Under certain conditions it may be necessary to install well points. These wells are driven directly into the subsurface. Applications include use as vadose zone monitoring or shallow piezometer wells.

However, the geologic subsurface must be compatible with this method. The utility of this method is limited because the annular space is generally not sealed to the surface. These types of wells are not



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acceptable for permanent monitoring well installations and should only be used under special circumstances.

### **3.2 WELLS INSTALLED THROUGH MULTIPLE SATURATED ZONES**

When wells are installed through multiple saturated zones, special well construction methods have to be used to assure well integrity and to limit the potential for cross- contamination. Generally, these types of wells are necessary if hydraulic units are separated by relatively impermeable layers. Two procedures which may be used are described below.

The borehole is advanced to the base of the first saturated zone. Casing is then anchored in the impermeable layer below and grouted to the surface. After the grouting has cured, a smaller diameter borehole is drilled through the grout. This procedure is repeated until the zone of interest is reached. After this zone is reached, a conventional well screen and riser casing is set. A typical well constructed in this manner is shown on Figure 2.

Another acceptable procedure involves driving a casing through several saturated layers while drilling ahead of the casing. This method, however, is not acceptable when a competent aquitard or aquiclude may be structurally damaged by the driven casing, because this method may result in cross contamination of two saturated layers.

### **3.3 WELL NESTS**

Well nest are installed when several distinct intervals in aquifer are to be sampled at each groundwater sampling location. These wells can be completed similarly to those described in Section 2.0. These wells can be installed in a single borehole or in close proximity to each other. When installing multiple wells in a single borehole, extreme care should be exercised when placing bentonite slurry seals above the filter packs. These seals must prevent flow between the wells in the single borehole.

**APPENDIX C  
STANDARD OPERATING PROCEDURE 020**

**PAGES 11 AND 12**

**FINAL  
FIELD SAMPLING PLAN  
SITE 14 GROUNDWATER INVESTIGATION AND  
SITE 25 REMEDIAL INVESTIGATION**

**THE ABOVE IDENTIFIED PAGES ARE NOT  
AVAILABLE.**

**EXTENSIVE RESEARCH WAS PERFORMED BY  
NAVFAC SOUTHWEST TO LOCATE THESE  
PAGES. THIS PAGE HAS BEEN INSERTED AS A  
PLACEHOLDER AND WILL BE REPLACED  
SHOULD THE MISSING ITEM BE LOCATED.**

**QUESTIONS MAY BE DIRECTED TO:**

**DIANE C. SILVA  
RECORDS MANAGEMENT SPECIALIST  
NAVAL FACILITIES ENGINEERING COMMAND  
SOUTHWEST  
1220 PACIFIC HIGHWAY  
SAN DIEGO, CA 92132**

**TELEPHONE: (619) 532-3676**

**ATTACHMENT A**  
**PHASE 2A AND PHASE 2B**  
**ENVIRONMENTAL BASELINE SURVEY RESULTS**

**EBS PHASE 2A RESULTS**

**Table 182-1**  
**Sample Collection Summary**  
**Parcel 182**

**NAS Alameda**  
**Project No. 762325**

Sample #	Date	Type	Matrix	Purpose	Sample Depth (ft)	Analytical Parameters	*Lab Type
182-0001	17-Nov-94	Surface Soil	Soil	TA-1	1 to 1.5	CLP Metals, TPH-EXT, TPH-PRG	F
182-0002	14-Nov-94	Surface Soil	Soil	TA-1	0 to 0.5	CLP Metals, TPH-EXT, TPH-PRG	F
182-0003	14-Nov-94	Surface Soil	Soil	Zone 16 TA-1	0.5 to 1	CLP Pesticides/PCB's	F
182-0004	18-Nov-94	Surface Soil	Soil	Zone 16 TA-3	0.5 to 1	CLP Metals, CLP Pesticides/PCB's, CLP SVOC, TPH-EXT, TPH-PRG	F
182-0005	18-Nov-94	Surface Soil	Soil	Zone 16 TA-3	0.5 to 1	CLP Metals, CLP Pesticides/PCB's, CLP SVOC, TPH-EXT, TPH-PRG	F
182-0006	14-Nov-94	Surface Soil	Soil	Zone 16 TA-1	0.5 to 1	CLP Pesticides/PCB's	F
182-0007M	25-May-95	Soil Gas	Air	Zone 16 TA-2	2.5 to 2.5	VOC (8240)	S
182-0008M	15-May-95	Soil Gas	Air	Zone 16 TA-3	3 to 3	VOC (8240)	S
182-0009M	25-May-95	Soil Gas	Air	Zone 16 TA-2	2.5 to 2.5	VOC (8240)	S

**Notes:**

TA = Target Area.

"M" at end of sample number indicates Mobile or Screening level laboratory sample (see Lab Type column).

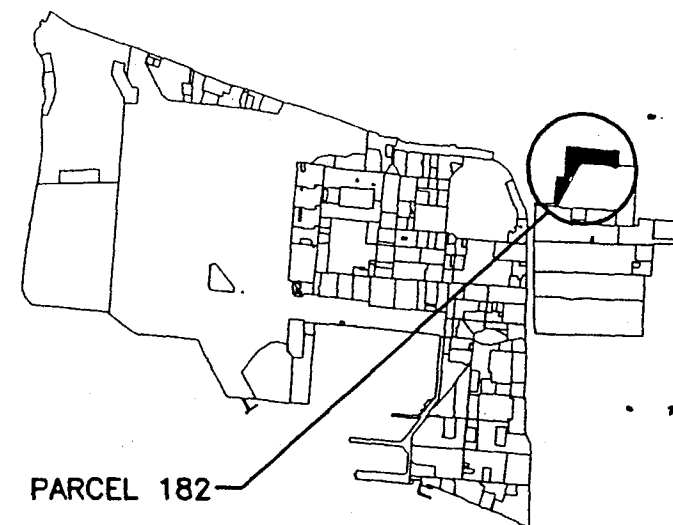
\* Lab Type: M = Mobile, S = Screening, F = Fixed-base.

DRAWING NUMBER 762325-B95

CHECKED BY  
APPROVED BY

BJ  
7-24-95

DRAWN BY



PARCEL 182

### KEY PLAN

#### GENERAL LEGEND

- PARCEL OUTLINE
- 2 ⬢ SUBSURFACE SOIL SAMPLE & NO.
- 6 ○ SURFACE SOIL SAMPLE & NO.
- ① TARGET AREA & NO.

#### FUEL LINE LEGEND

- - - FUEL LINES ABANDONED
- - - FUEL LINES IN USE

#### SANITARY SEWER LINE LEGEND

- 10 ■ SANITARY SEWER MANHOLE NO.
- ET GREASE TRAP
- SW — SANITARY SEWER LINE

#### MATERIALS:

C.I. — CAST IRON

#### NOTES:

1. ALL SANITARY SEWERS ARE VITRIFIED CLAY PIPE UNLESS NOTED OTHERWISE.

#### INDUSTRIAL WASTE LINE LEGEND

- INDUSTRIAL WASTE MANHOLE & NO.
- IW — INDUSTRIAL WASTE LINE

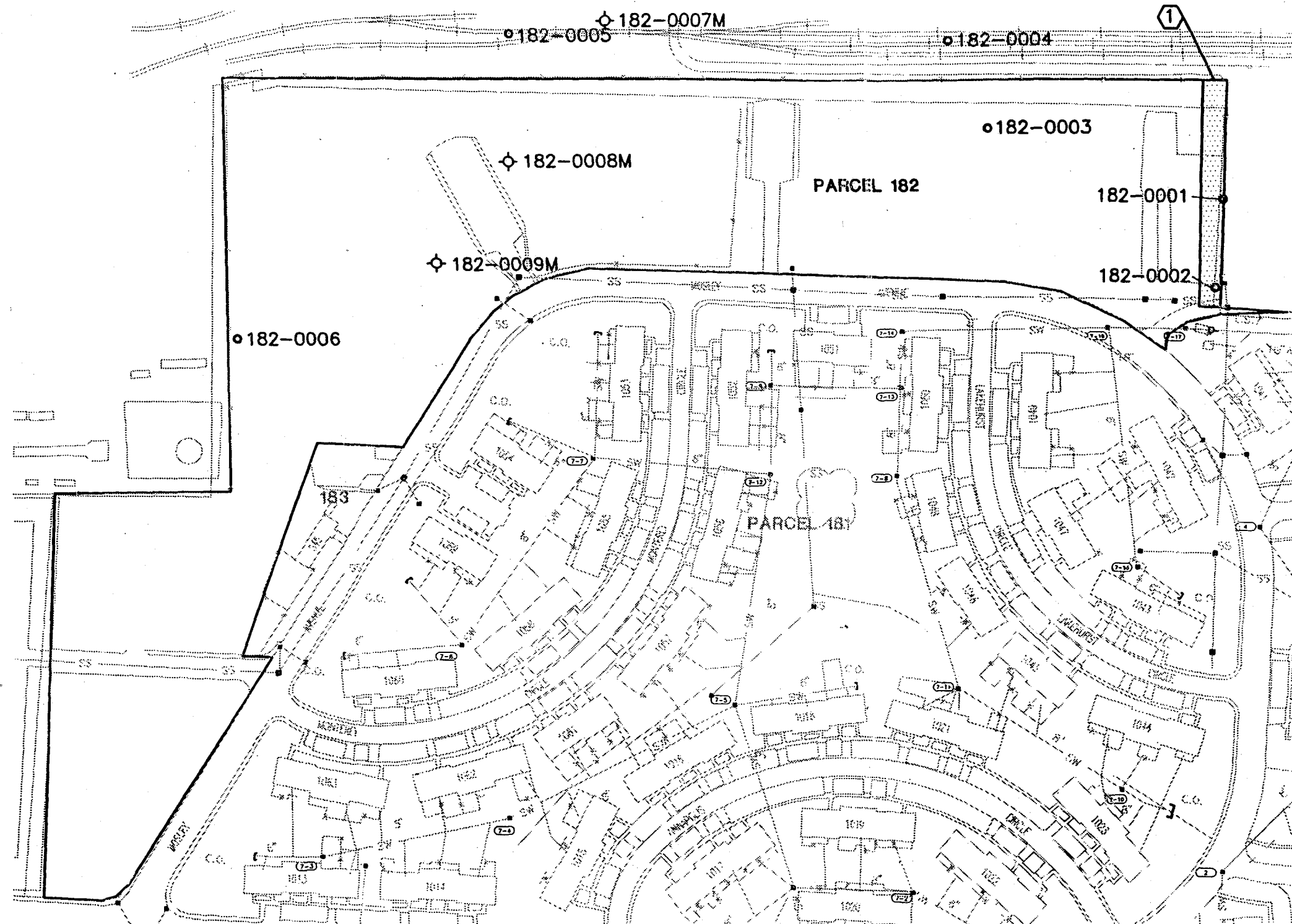
#### STORM DRAIN LEGEND

- 12A-1 ■ STORM DRAIN MANHOLE & NO.
- CATCH BASIN
- SS — STORM SEWER LINE

#### MATERIALS:

RC — REINFORCED CONCRETE

NOTE: PARCEL BOUNDARIES ARE APPROXIMATE.



**DRAFT**

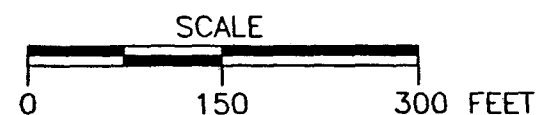


FIGURE 182-1

PARCEL 182  
SAMPLE LOCATION MAP

PREPARED FOR  
ALAMEDA NAVAL AIR STATION  
ALAMEDA, CALIFORNIA

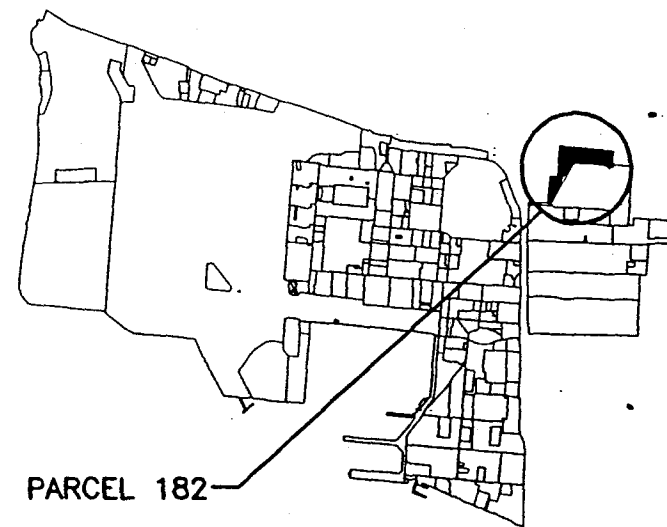
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CHECKED BY B.J. 10-11-95

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### KEY PLAN

#### GENERAL LEGEND

- PARCEL OUTLINE
- 2 + SUBSURFACE SOIL SAMPLE & NO.
- 6 • SURFACE SOIL SAMPLE & NO.
- ① TARGET AREA & NO.

#### FUEL LINE LEGEND

- - - FUEL LINES ABANDONED
- - - FUEL LINES IN USE

#### SANITARY SEWER LINE LEGEND

- 10 ■ SANITARY SEWER MANHOLE NO.
- GREASE TRAP
- SW — SANITARY SEWER LINE

#### MATERIALS:

C.I. — CAST IRON

#### NOTES:

1. ALL SANITARY SEWERS ARE VITRIFIED CLAY PIPE UNLESS NOTED OTHERWISE.

#### INDUSTRIAL WASTE LINE LEGEND

- INDUSTRIAL WASTE MANHOLE & NO.
- IW — INDUSTRIAL WASTE LINE

#### STORM DRAIN LEGEND

- 12A-1 ■ STORM DRAIN MANHOLE & NO.
- CATCH BASIN
- SS — STORM SEWER LINE

#### MATERIALS:

RC — REINFORCED CONCRETE

NOTE: PARCEL BOUNDARIES ARE APPROXIMATE.

182-0005	DEPTH (FT.)	VALUE	DATA QUAL.	DETECT. LIMIT	UNITS
DI-N-BUTYLPHTHALATE	1.0	620	B	390	µG/KG
DIETHYLPHTHALATE	1.0	51	J	390	µG/KG

182-0007M

182-0005

182-0008M

PARCEL 182

182-0009M

182-0006

183

PARCEL 181

182-0004	DEPTH (FT.)	VALUE	DATA QUAL.	DETECT. LIMIT	UNITS
ACENAPHTHENE	1.0	220	J	430	µG/KG
ACENAPHTHYLENE	1.0	150	J	430	µG/KG
ANTHRACENE	1.0	220	J	430	µG/KG
BENZO(A)ANTHRACENE	1.0	1100	J	430	µG/KG
BENZO(A)PYRENE	1.0	1900	J	430	µG/KG
BENZO(B)FLUORANTHENE	1.0	2500	J	430	µG/KG
BENZO(G,H)PERYLENE	1.0	2800	J	430	µG/KG
BENZO(K)FLUORANTHENE	1.0	1000	J	430	µG/KG
CHRYSENE	1.0	1500	J	430	µG/KG
DIBENZO(A,H)ANTHRACENE	1.0	350	J	430	µG/KG
DIETHYLPHTHALATE	1.0	180	J	430	µG/KG
FLUORANTHENE	1.0	3500	J	430	µG/KG
FLUORENE	1.0	174	J	430	µG/KG
INDENO(1,2,3-CD)PYRENE	1.0	2700	J	430	µG/KG
NAPHTHALENE	1.0	80	J	430	µG/KG
PHENANTHRENE	1.0	11700	J	430	µG/KG
PYRENE	1.0	3500	J	430	µG/KG

182-0004

182-0003

182-0001

182-0002

FIGURE 182-2

PARCEL 182  
SVOC CONCENTRATIONS IN SOIL

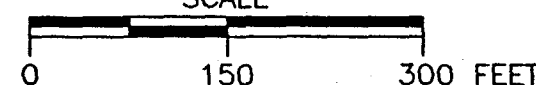
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**DRAFT**

SCALE

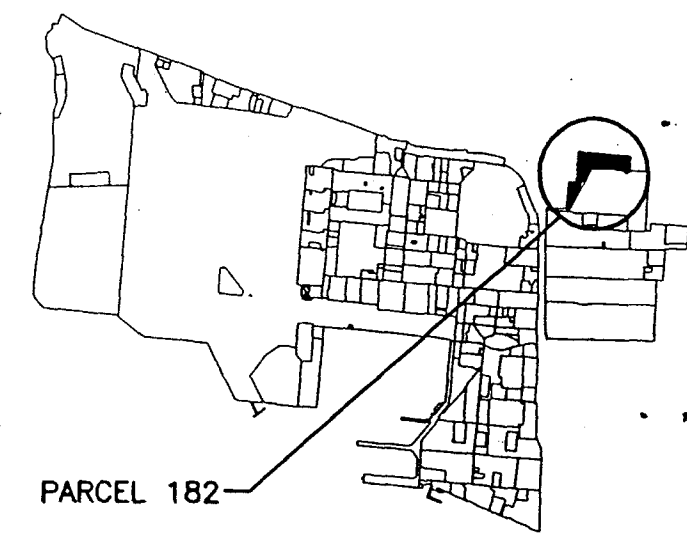


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**KEY PLAN**

**GENERAL LEGEND**

- PARCEL OUTLINE
- 2 ⊕ SUBSURFACE SOIL SAMPLE & NO.
- 6 ○ SURFACE SOIL SAMPLE & NO.
- ① TARGET AREA & NO.

**FUEL LINE LEGEND**

- - - FUEL LINES ABANDONED
- - - FUEL LINES IN USE

**SANITARY SEWER LINE LEGEND**

- 10 ■ SANITARY SEWER MANHOLE NO.
- ET GREASE TRAP
- SW — SANITARY SEWER LINE

**MATERIALS:**

- C.I. — CAST IRON

**NOTES:**

1. ALL SANITARY SEWERS ARE VITRIFIED CLAY PIPE UNLESS NOTED OTHERWISE.

**INDUSTRIAL WASTE LINE LEGEND**

- INDUSTRIAL WASTE MANHOLE & NO.
- IW — INDUSTRIAL WASTE LINE

**STORM DRAIN LEGEND**

- 12A-1 ■ STORM DRAIN MANHOLE & NO.
- CATCH BASIN
- SS — STORM SEWER LINE

**MATERIALS:**

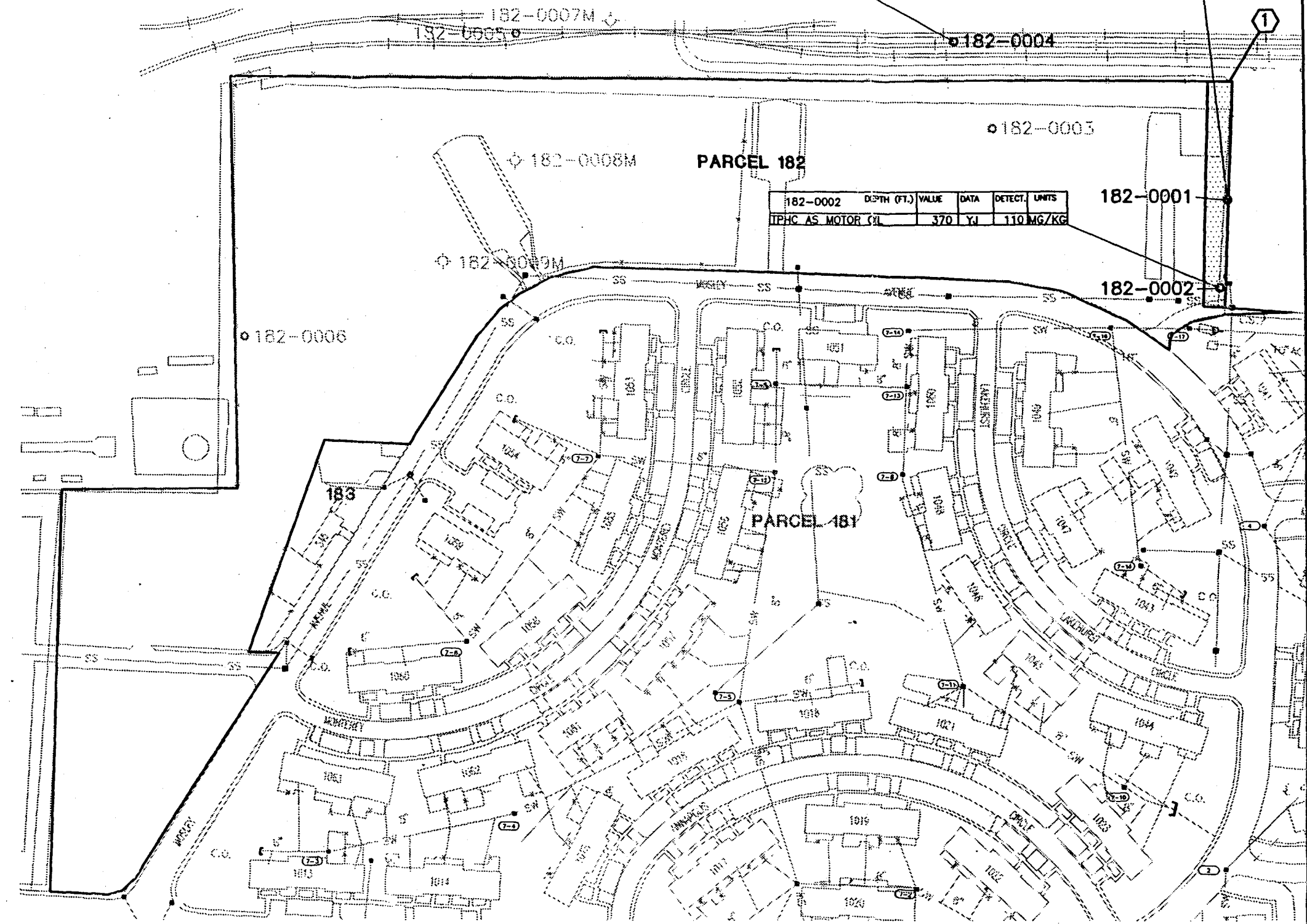
- RC — REINFORCED CONCRETE

NOTE: PARCEL BOUNDARIES ARE APPROXIMATE.

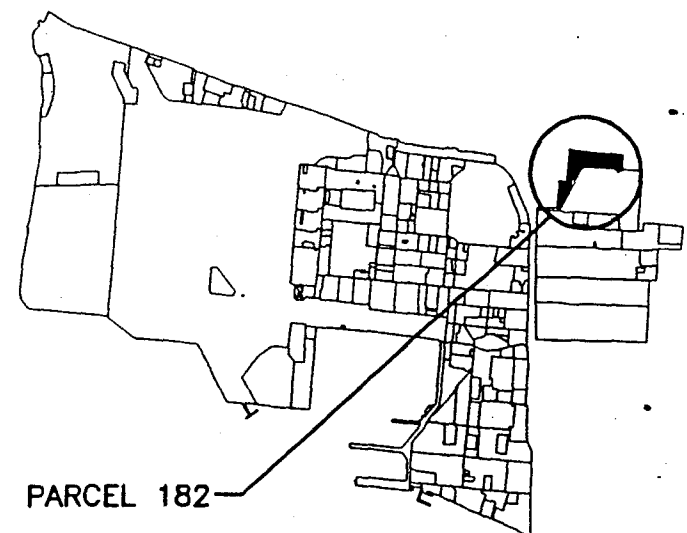
182-0004	DEPTH (FT.)	VALUE	DATA	DETECT.	UNITS
TPHC AS MOTOR OIL	160	YJ	26	MG/KG	

182-0001	DEPTH (FT.)	VALUE	DATA	DETECT.	UNITS
TPHC AS MOTOR OIL	60	YJ	22	MG/KG	

182-0002	DEPTH (FT.)	VALUE	DATA	DETECT.	UNITS
TPHC AS MOTOR OIL	370	YJ	110	MG/KG	







### KEY PLAN

#### GENERAL LEGEND

- PARCEL OUTLINE
- ◆ SURFACE AND SUBSURFACE HYDROPUNCH LOCATIONS
- ⊗ PROPOSED SUBSURFACE SOIL AND HYDROPUNCH GROUNDWATER SAMPLING LOCATIONS
- 2 ◆ SUBSURFACE SOIL SAMPLE & NO.
- 6 ○ SURFACE SOIL SAMPLE & NO.
- ① TARGET AREA & NO.

#### FUEL LINE LEGEND

- - - FUEL LINES ABANDONED
- - - FUEL LINES IN USE

#### SANITARY SEWER LINE LEGEND

- 10 ■ SANITARY SEWER MANHOLE NO.
- GREASE TRAP
- SW — SANITARY SEWER LINE

#### MATERIALS:

C.I. — CAST IRON

#### NOTES:

1. ALL SANITARY SEWERS ARE VITRIFIED CLAY PIPE UNLESS NOTED OTHERWISE.

#### INDUSTRIAL WASTE LINE LEGEND

- INDUSTRIAL WASTE MANHOLE & NO.
- IW — INDUSTRIAL WASTE LINE

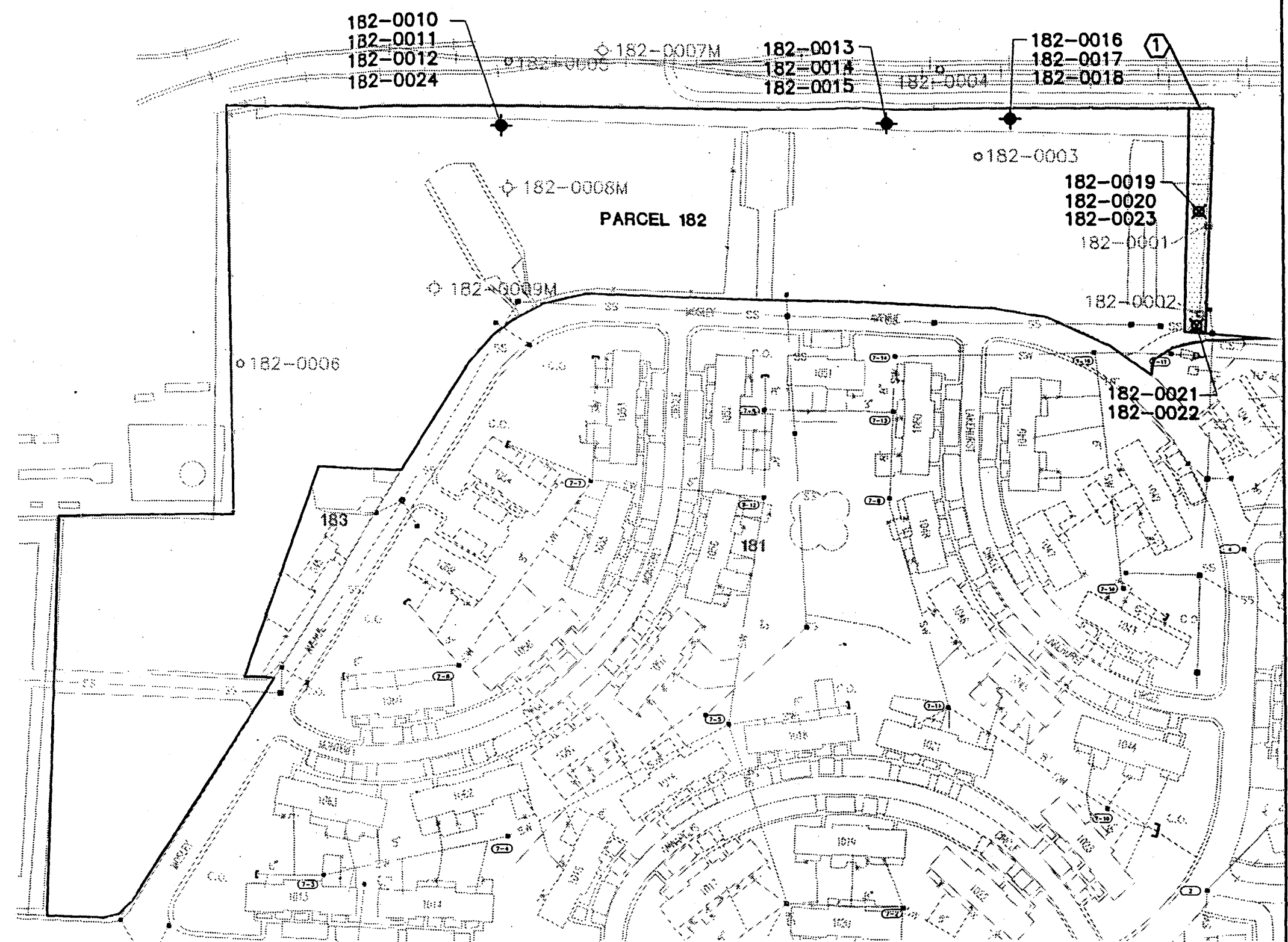
#### STORM DRAIN LEGEND

- 12A-1 ■ STORM DRAIN MANHOLE & NO.
- CATCH BASIN
- SS — STORM SEWER LINE

#### MATERIALS:

RC — REINFORCED CONCRETE

NOTE: PARCEL BOUNDARIES ARE APPROXIMATE.



**DRAFT**

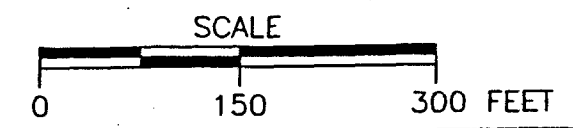
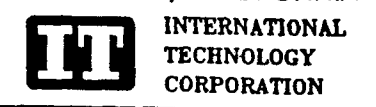


FIGURE 182-4  
PARCEL 182  
PROPOSED SAMPLING LOCATION MAP

PREPARED FOR  
ALAMEDA NAVAL AIR STATION  
ALAMEDA, CALIFORNIA



**EBS PHASE 2B RESULTS**

**Table 182-1**  
**Phase 2B Sample Collection Summary**  
**Parcel 182**

**NAS Alameda**  
**Project 762325**

Sample #	Date	Type*	Matrix	Purpose	Sample Depth (ft)**	Analytical Parameters	Lab Type***
182-0010	18-Oct-95	Surface Soil	Soil	Zone 16 TA-4	0.5 to 1.0	CLP SVOC, TPH-EXT, TPH-PRG	F
182-0011	18-Oct-95	Subsurface Soil	Soil	Zone 16 TA-4	7.0 to 7.5	CLP SVOC, TPH-EXT, TPH-PRG	F
182-0012	19-Oct-95	Hydropunch	Water	Zone 16 TA-4	6.0 to 10.0	TPH-PRG	F
182-0013	19-Oct-95	Surface Soil	Soil	Zone 16 TA-4	0.5 to 1.0	CLP SVOC, TPH-EXT, TPH-PRG	F
182-0014	19-Oct-95	Subsurface Soil	Soil	Zone 16 TA-4	6.5 to 7.0	CLP SVOC, TPH-EXT, TPH-PRG	F
182-0015	19-Oct-95	Hydropunch	Water	Zone 16 TA-4	6.0 to 10.0	CLP SVOC, TPH-EXT, TPH-PRG	F
182-0016	19-Oct-95	Surface Soil	Soil	Zone 16 TA-4	0.5 to 1.0	CLP SVOC, TPH-EXT, TPH-PRG	F
182-0017	19-Oct-95	Subsurface Soil	Soil	Zone 16 TA-4	6.5 to 7.0	CLP SVOC, TPH-EXT, TPH-PRG	F
182-0018	19-Oct-95	Hydropunch	Water	Zone 16 TA-4	5.0 to 9.0	CLP SVOC, TPH-PRG	F
182-0019	18-Oct-95	Subsurface Soil	Soil	TA-2	7.5 to 8.0	CLP SVOC, TPH-EXT, TPH-PRG	F
182-0021	19-Oct-95	Subsurface Soil	Soil	TA-2	7.5 to 8.0	CLP SVOC, TPH-EXT, TPH-PRG	F
182-0022	19-Oct-95	Hydropunch	Water	TA-2	4.5 to 8.5	TPH-PRG	F
182-0023	19-Oct-95	Hydropunch	Water	Field Duplicate (1)	4.5 to 8.5	TPH-PRG	F
182-0024	18-Oct-95	Surface Soil	Soil	Field Duplicate (2)	1.0 to 1.5	CLP SVOC, TPH-EXT, TPH-PRG	F

**Notes:**

TA = Target Area.

\* Surface soil sample taken below subgrade.

Subsurface soil sample taken at the capillary fringe.

Hydropunch taken approximately 3 ft below water table.

\*\* Sample depth indicates depth below ground surface.

\*\*\* Lab Type: M = Mobile, S = Screening, F = Fixed-base.

(1) Field Duplicate of sample number 182-0022.

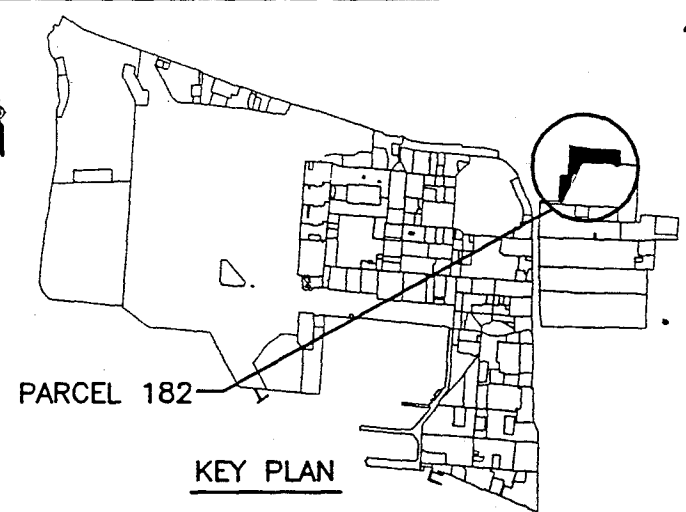
(2) Field Duplicate of sample number 182-0010.

DRAWING NUMBER  
762325-B379

CHECKED BY  
APPROVED BY

BJ  
8-23-96

DRAWN BY



# GENERAL LEGEND

- PARCEL OUTLINE
- HYDROPUNCH SAMPLING LOCATION
- HYDROPUNCH AND SURFACE SAMPLING LOCATIONS
- SURFACE AND SUBSURFACE SOIL AND HYDROPUNCH SAMPLING LOCATIONS
- SURFACE SOIL SAMPLING LOCATION
- SURFACE AND SUBSURFACE SOIL SAMPLING LOCATIONS
- SUBSURFACE SOIL SAMPLING LOCATION
- SUBSURFACE SOIL AND HYDROPUNCH SAMPLING LOCATIONS
- SUBSURFACE SOIL SAMPLE
- SURFACE SOIL SAMPLE
- SOIL GAS SAMPLE
- PHASE 2A TARGET AREA

# FUEL LINE LEGEND

- FUEL LINES ABANDONED
- FUEL LINES IN USE

# SANITARY SEWER LINE LEGEND

- SANITARY SEWER MANHOLE NO.
- GREASE TRAP
- SANITARY SEWER LINE

# MATERIALS:

C.I. - CAST IRON

# NOTES:

1. ALL SANITARY SEWERS ARE VITRIFIED CLAY PIPE UNLESS NOTED OTHERWISE.

# INDUSTRIAL WASTE LINE LEGEND

- INDUSTRIAL WASTE MANHOLE & NO.
- INDUSTRIAL WASTE LINE

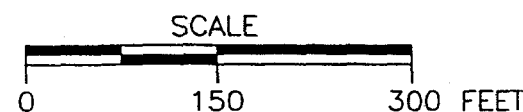
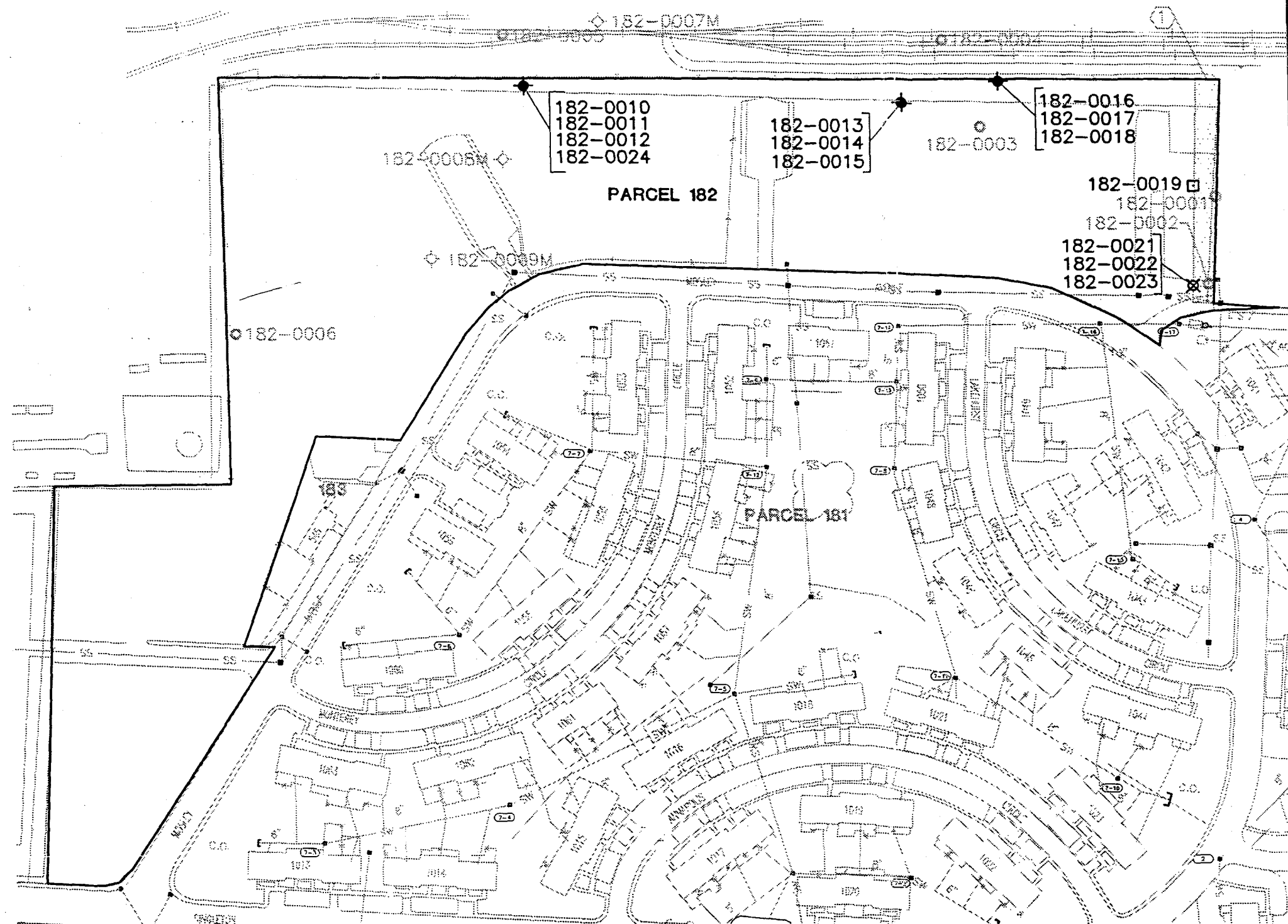
# STORM DRAIN LEGEND

- STORM DRAIN MANHOLE & NO.
- CATCH BASIN
- STORM SEWER LINE

# MATERIALS:

RC - REINFORCED CONCRETE

NOTE: PARCEL BOUNDARIES ARE APPROXIMATE.



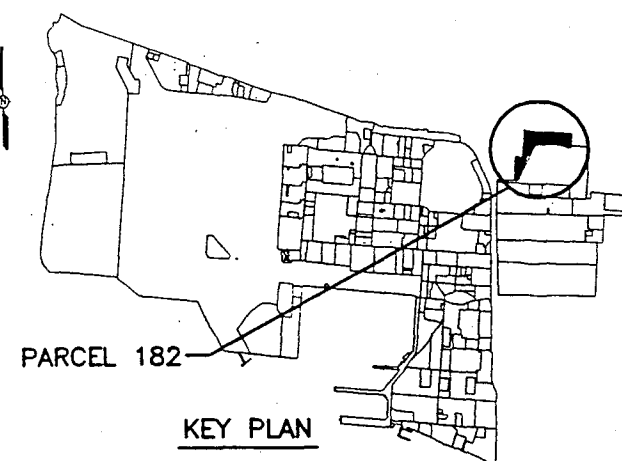
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EBS PHASE 2B  
FIGURE 182-1

PARCEL 182  
SAMPLE LOCATION MAP

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ALAMEDA, CALIFORNIA

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## GENERAL LEGEND

- PARCEL OUTLINE  
HYDROPUNCH SAMPLING LOCATION  
HYDROPUNCH AND SURFACE SAMPLING LOCATIONS  
SURFACE AND SUBSURFACE SOIL AND HYDROPUNCH SAMPLING LOCATIONS  
SURFACE SOIL SAMPLING LOCATION  
SURFACE AND SUBSURFACE SOIL SAMPLING LOCATIONS  
SUBSURFACE SOIL SAMPLING LOCATION  
SUBSURFACE SOIL AND HYDROPUNCH SAMPLING LOCATIONS  
SUBSURFACE SOIL SAMPLE  
SURFACE SOIL SAMPLE  
SOIL GAS SAMPLE  
PHASE 2A TARGET AREA

## FUEL LINE LEGEND

- FUEL LINES ABANDONED  
FUEL LINES IN USE

## SANITARY SEWER LINE LEGEND

- 10 SANITARY SEWER MANHOLE NO.  
GREASE TRAP  
SW SANITARY SEWER LINE

## MATERIALS:

- C.I. CAST IRON

## NOTES:

1. ALL SANITARY SEWERS ARE VITRIFIED CLAY PIPE UNLESS NOTED OTHERWISE.

## INDUSTRIAL WASTE LINE LEGEND

- INDUSTRIAL WASTE MANHOLE & NO.  
IW INDUSTRIAL WASTE LINE

## STORM DRAIN LEGEND

- 12A-1 STORM DRAIN MANHOLE & NO.  
CATCH BASIN  
SS STORM SEWER LINE

## MATERIALS:

- RC REINFORCED CONCRETE

## NOTES:

1. 2B DETECTIONS ARE INDICATED BY DOUBLED BOX.  
2. PARCEL BOUNDARIES ARE APPROXIMATE.

182-0005	DEPTH (FT.)	VALUE	DATA QUAL	DETECT. LIMIT	UNITS
DI-N-BUTYLPHTHALATE	1.0	620	B	390	µg/kg
DIETHYLPHTHALATE	1.0	51	J	390	µg/kg

182-0010	DEPTH (FT.)	VALUE	DATA QUAL	DETECT. LIMIT	UNITS
BENZO(A)ANTHRACENE	1.0	230	J	370	µg/kg
BENZO(A)PYRENE	1.0	260	J	370	µg/kg
BENZO(B)FLUORANTHENE	1.0	280	J	370	µg/kg
BENZO(G,H)PERYLENE	1.0	220	J	370	µg/kg
BENZO(K)FLUORANTHENE	1.0	78	J	370	µg/kg
CHRYSENE	1.0	230	J	370	µg/kg
INDENO(1,2,3-CD)PYRENE	1.0	206	J	370	µg/kg

182-0011	DEPTH (FT.)	VALUE	DATA QUAL	DETECT. LIMIT	UNITS
ACENAPHTHENE	1.0	1,300	J	3,800	µg/kg
ACENAPHTHYLENE	1.0	15,000	J	3,800	µg/kg
ANTHRACENE	1.0	29,000	J	3,800	µg/kg
BENZO(A)ANTHRACENE	1.0	100,000	D	3,800	µg/kg
BENZO(A)PYRENE	1.0	130,000	D	3,800	µg/kg
BENZO(B)FLUORANTHENE	1.0	110,000	D	3,800	µg/kg
BENZO(G,H)PERYLENE	1.0	79,000	D	3,800	µg/kg
BENZO(K)FLUORANTHENE	1.0	21,000	J	3,800	µg/kg
CARBAZOLE	1.0	1,100	J	3,800	µg/kg
CHRYSENE	1.0	99,000	D	3,800	µg/kg
DIBENZO(A,H)ANTHRACENE	1.0	8,300	J	3,800	µg/kg
FLUORANTHENE	1.0	290,000	D	3,800	µg/kg
FLUORENE	1.0	1,200	J	3,800	µg/kg
INDENO(1,2,3-CD)PYRENE	1.0	77,000	D	3,800	µg/kg
NAPHTHALENE	1.0	880	J	3,800	µg/kg
PHENANTHRENE	1.0	206,300	D	3,800	µg/kg
PYRENE	1.0	140,000	J	3,800	µg/kg

182-0024	DEPTH (FT.)	VALUE	DATA QUAL	DETECT. LIMIT	UNITS
ACENAPHTHYLENE	1.0	83	J	380	µg/kg
ANTHRACENE	1.0	76	J	380	µg/kg
BENZO(A)ANTHRACENE	1.0	500	J	380	µg/kg
BENZO(A)PYRENE	1.0	730	J	380	µg/kg
BENZO(B)FLUORANTHENE	1.0	730	J	380	µg/kg
BENZO(G,H)PERYLENE	1.0	630	J	380	µg/kg
BENZO(K)FLUORANTHENE	1.0	180	J	380	µg/kg
CHRYSENE	1.0	500	J	380	µg/kg
DIBENZO(A,H)ANTHRACENE	1.0	65	J	380	µg/kg
FLUORANTHENE	1.0	1,300	J	380	µg/kg
FLUORENE	1.0	600	J	380	µg/kg
INDENO(1,2,3-CD)PYRENE	1.0	700	J	380	µg/kg
PHENANTHRENE	1.0	700	J	380	µg/kg
PYRENE	1.0	1,800	J	380	µg/kg

182-0013	DEPTH (FT.)	VALUE	DATA QUAL	DETECT. LIMIT	UNITS
ACENAPHTHENE	1.0	450	J	3,800	µg/kg
ACENAPHTHYLENE	1.0	2,400	J	3,800	µg/kg
ANTHRACENE	1.0	2,100	J	3,800	µg/kg
BENZO(A)ANTHRACENE	1.0	17,000	J	3,800	µg/kg
BENZO(B)FLUORANTHENE	1.0	22,000	J	3,800	µg/kg
BENZO(G,H)PERYLENE	1.0	20,000	J	3,800	µg/kg
BENZO(K)FLUORANTHENE	1.0	27,000	J	3,800	µg/kg
CHRYSENE	1.0	6,800	J	3,800	µg/kg
DIBENZO(A,H)ANTHRACENE	1.0	3,300	J	3,800	µg/kg
FLUORANTHENE	1.0	53,000	DJ	3,800	µg/kg
FLUORENE	1.0	520	J	3,800	µg/kg
NAPHTHALENE	1.0	17,800	J	3,800	µg/kg
PHENANTHRENE	1.0	65,000	DJ	3,800	µg/kg
PYRENE	1.0	65,000	DJ	3,800	µg/kg

182-0014	DEPTH (FT.)	VALUE	DATA QUAL	DETECT. LIMIT	UNITS
BENZO(A)ANTHRACENE	1.0	65	J	350	µg/kg
BENZO(A)PYRENE	1.0	170	J	350	µg/kg
BENZO(B)FLUORANTHENE	1.0	140	J	350	µg/kg
BENZO(G,H)PERYLENE	1.0	270	J	350	µg/kg
BENZO(K)FLUORANTHENE	1.0	44	J	350	µg/kg
CHRYSENE	1.0	154	J	350	µg/kg
FLUORANTHENE	1.0	1160	J	350	µg/kg
INDENO(1,2,3-CD)PYRENE	1.0	1140	J	350	µg/kg
PYRENE	1.0	1,250	J	350	µg/kg

182-0004	DEPTH (FT.)	VALUE	DATA QUAL	DETECT. LIMIT	UNITS
ACENAPHTHENE	1.0	220	J	430	µg/kg
ACENAPHTHYLENE	1.0	150	J	430	µg/kg
ANTHRACENE	1.0	220	J	430	µg/kg
BENZO(A)ANTHRACENE	1.0	1,100	J	430	µg/kg
BENZO(A)PYRENE	1.0	1,900	J	430	µg/kg
BENZO(B)FLUORANTHENE	1.0	2,500	J	430	µg/kg
BENZO(G,H)PERYLENE	1.0	2,800	J	430	µg/kg
BENZO(K)FLUORANTHENE	1.0	1,000	J	430	µg/kg
CHRYSENE	1.0	1,500	J	430	µg/kg
DIBENZO(A,H)ANTHRACENE	1.0	350	J	430	µg/kg
DIETHYLPHTHALATE	1.0	80	J	430	µg/kg
FLUORANTHENE	1.0	3,500	J	430	µg/kg
FLUORENE	1.0	24	J	430	µg/kg
INDENO(1,2,3-CD)PYRENE	1.0	2,700	J	430	µg/kg
NAPHTHALENE	1.0	80	J	430	µg/kg
PHENANTHRENE	1.0	1,700	J	430	µg/kg
PYRENE	1.0	3,500	J	430	µg/kg

182-0016	DEPTH (FT.)	VALUE	DATA QUAL	DETECT. LIMIT	UNITS
2-METHYLNAPHTHALENE	1.0	210	J	410	µg/kg
ACENAPHTHENE	1.0	2,000	J	410	µg/kg
ACENAPHTHYLENE	1.0	1,500	J	410	µg/kg
ANTHRACENE	1.0	3,200	J	410	µg/kg
BENZO(A)PYRENE	1.0	19,000	DJ	410	µg/kg
BENZO(B)FLUORANTHENE	1.0	12,000	DJ	410	µg/kg
BENZO(G,H)PERYLENE	1.0	5,500	DJ	410	µg/kg
CHRYSENE	1.0	15,000	DJ	410	µg/kg
DIBENZO(A,H)ANTHRACENE	1.0	1,700	J	410	µg/kg
DIBENZOFURAN	1.0	68	J	410	µg/kg
FLUORANTHENE	1.0	41,000	DJ	410	µg/kg
FLUORENE	1.0	880	J	410	µg/kg
INDENO(1,2,3-CD)PYRENE	1.0	14,000	DJ	410	µg/kg
PHENANTHRENE	1.0	25,000	DJ	410	µg/kg
PYRENE	1.0	54,000	DJ	410	µg/kg

182-0017	DEPTH (FT.)	VALUE	DATA QUAL	DETECT. LIMIT	UNITS
BENZO(A)ANTHRACENE	1.0	100	J	500	µg/kg
BENZO(A)PYRENE	1.0	340	J	500	µg/kg
BENZO(B)FLUORANTHENE	1.0	340	J	500	µg/kg
BENZO(G,H)PERYLENE	1.0	700	J	500	µg/kg
BENZO(K)FLUORANTHENE	1.0	110	J	500	µg/kg
CHRYSENE	1.0	120	J	500	µg/kg
FLUORANTHENE	1.0	370	J	500	µg/kg
INDENO(1,2,3-CD)PYRENE	1.0	283	J	500	µg/kg

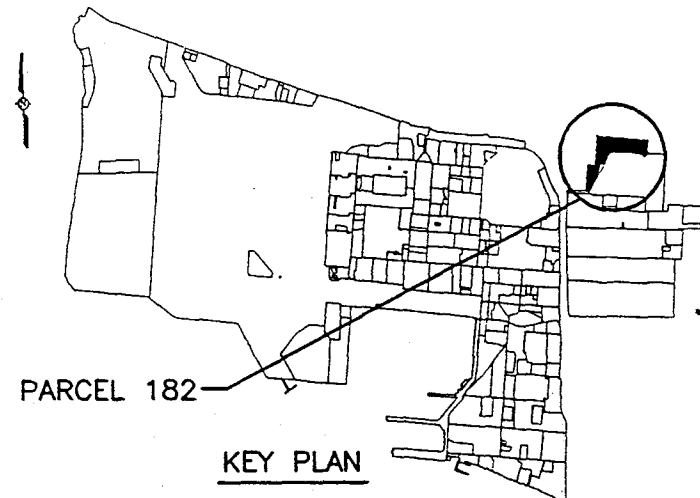
182-0019	DEPTH (FT.)	VALUE	DATA QUAL	DETECT. LIMIT	UNITS
BENZO(A)ANTHRACENE	1.0	140	J	400	µg/kg
BENZO(A)PYRENE	1.0	230	J	400	µg/kg
BENZO(B)FLUORANTHENE	1.0	150	J	400	µg/kg
BENZO(G,H)PERYLENE	1.0	730	J	400	µg/kg
BENZO(K)FLUORANTHENE	1.0	43	J	400	µg/kg
CHRYSENE	1.0	140	J	400	µg/kg
FLUORANTHENE	1.0	350	J	400	µg/kg
INDENO(1,2,3-CD)PYRENE	1.0	270	J	400	µg/kg
PHENANTHRENE	1.0	240	J	400	µg/kg
PYRENE	1.0	460	J	400	µg/kg

EBS PHASE 2B  
FIGURE 182-2PARCEL 182  
SVOC CONCENTRATIONS IN SOIL  
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APPROVED BY 8-23-96  
DRAWN BY



#### GENERAL LEGEND

- PARCEL OUTLINE
- HYDROPUNCH SAMPLING LOCATION
- HYDROPUNCH AND SURFACE SAMPLING LOCATIONS
- SURFACE AND SUBSURFACE SOIL AND HYDROPUNCH SAMPLING LOCATIONS
- 2B SURFACE SOIL SAMPLING LOCATION
- SURFACE AND SUBSURFACE SOIL SAMPLING LOCATIONS
- SUBSURFACE SOIL SAMPLING LOCATION
- SUBSURFACE SOIL AND HYDROPUNCH SAMPLING LOCATIONS
- SUBSURFACE SOIL SAMPLE
- 2A SURFACE SOIL SAMPLE
- SOIL GAS SAMPLE
- PHASE 2A TARGET AREA

#### FUEL LINE LEGEND

- FUEL LINES ABANDONED
- FUEL LINES IN USE

#### SANITARY SEWER LINE LEGEND

- 10 SANITARY SEWER MANHOLE NO.
- GREASE TRAP
- SW SANITARY SEWER LINE

#### MATERIALS:

C.I. CAST IRON

#### NOTES:

1. ALL SANITARY SEWERS ARE VITRIFIED CLAY PIPE UNLESS NOTED OTHERWISE.

#### INDUSTRIAL WASTE LINE LEGEND

- INDUSTRIAL WASTE MANHOLE & NO.
- IW INDUSTRIAL WASTE LINE

#### STORM DRAIN LEGEND

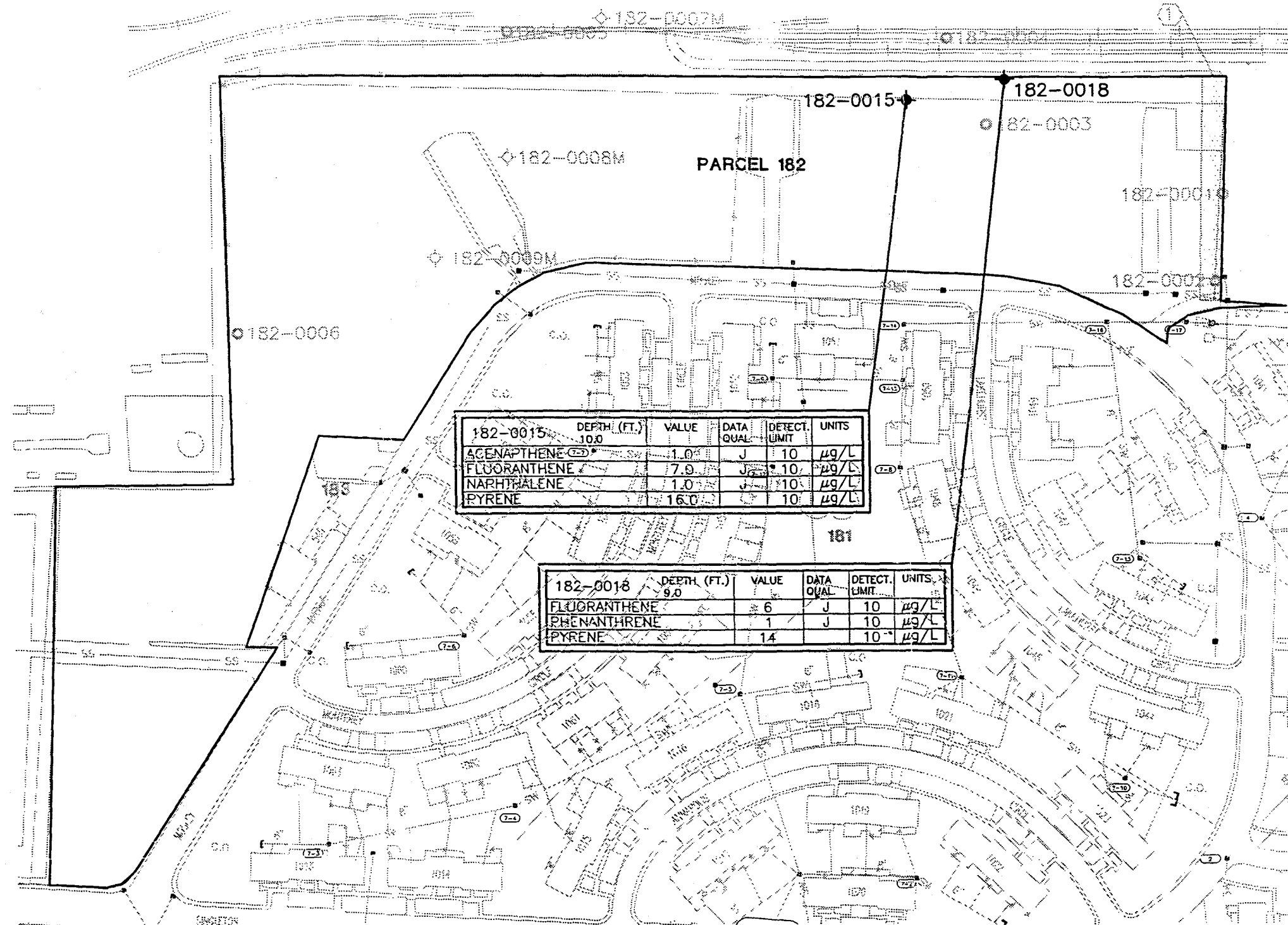
- 12A-1 STORM DRAIN MANHOLE & NO.
- CATCH BASIN
- SS STORM SEWER LINE

#### MATERIALS:

RC REINFORCED CONCRETE

#### NOTES:

1. 2B DETECTIONS ARE INDICATED BY DOUBLED BOX.
2. PARCEL BOUNDARIES ARE APPROXIMATE.



DRAFT

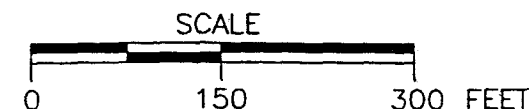
EBS PHASE 2B  
FIGURE 182-3

PARCEL 182  
SVOC CONCENTRATIONS IN GROUNDWATER

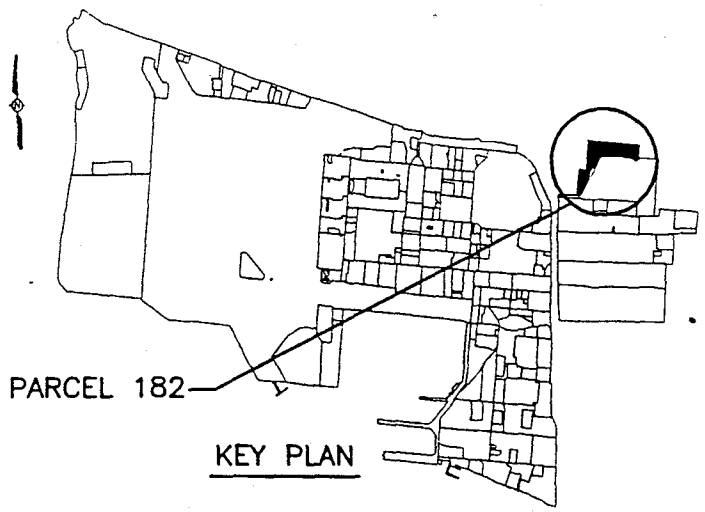
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- GENERAL LEGEND**
- PARCEL OUTLINE
  - HYDROPUNCH SAMPLING LOCATION
  - HYDROPUNCH AND SURFACE SAMPLING LOCATIONS
  - SURFACE AND SUBSURFACE SOIL AND HYDROPUNCH SAMPLING LOCATIONS
  - SURFACE SOIL SAMPLING LOCATION
  - SURFACE AND SUBSURFACE SOIL SAMPLING LOCATIONS
  - SUBSURFACE SOIL SAMPLING LOCATION
  - SUBSURFACE SOIL AND HYDROPUNCH SAMPLING LOCATIONS
  - SUBSURFACE SOIL SAMPLE
  - SURFACE SOIL SAMPLE
  - SOIL GAS SAMPLE
  - PHASE 2A TARGET AREA

- FUEL LINE LEGEND**
- FUEL LINES ABANDONED
  - FUEL LINES IN USE

- SANITARY SEWER LINE LEGEND**
- SANITARY SEWER MANHOLE NO.
  - GREASE TRAP
  - SANITARY SEWER LINE

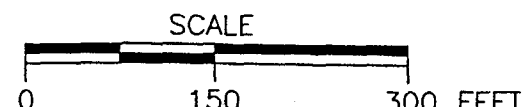
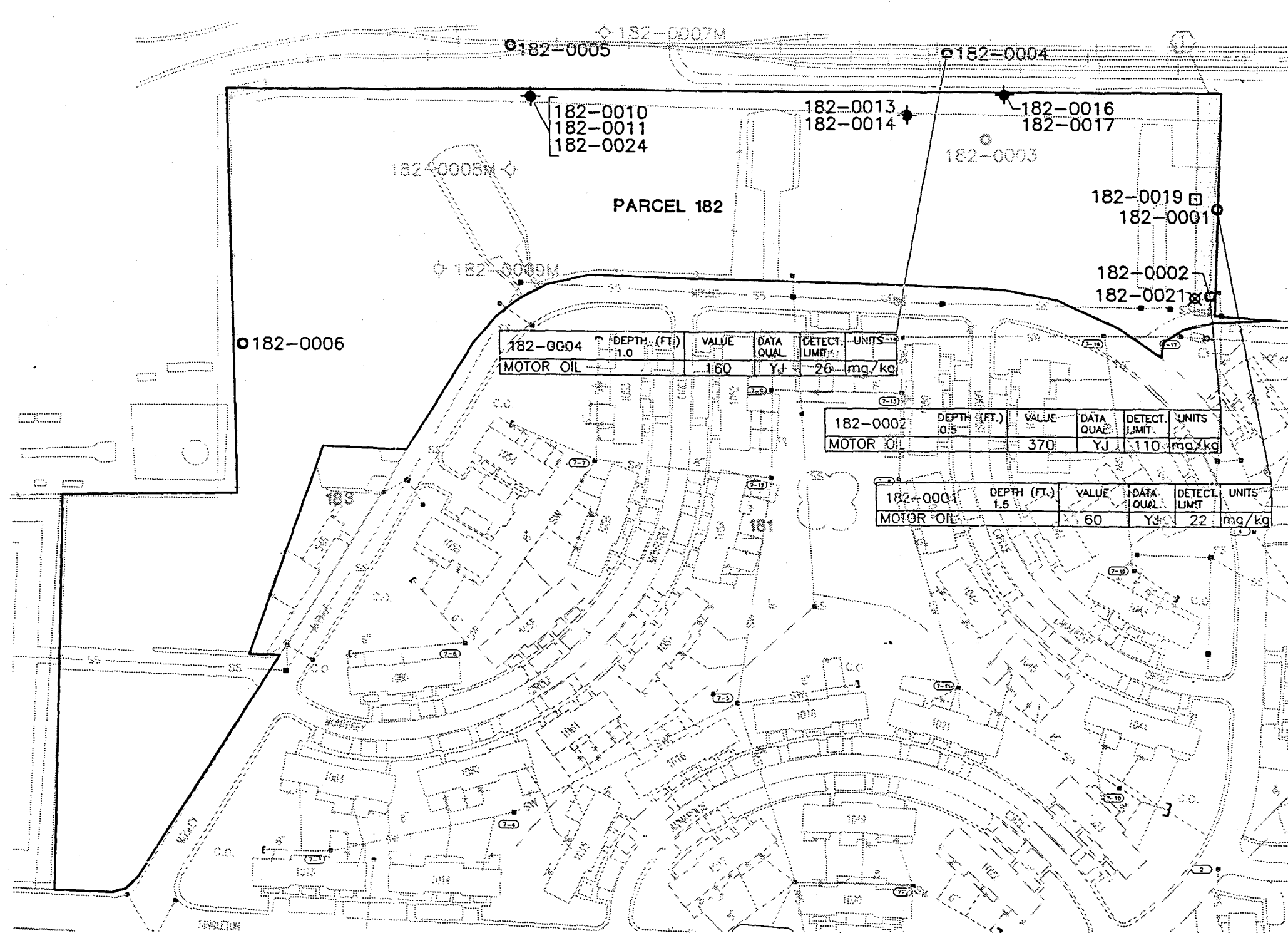
**MATERIALS:**  
C.I. — CAST IRON

**NOTES:**  
1. ALL SANITARY SEWERS ARE VITRIFIED CLAY PIPE UNLESS NOTED OTHERWISE.

- INDUSTRIAL WASTE LINE LEGEND**
- INDUSTRIAL WASTE MANHOLE & NO.
  - INDUSTRIAL WASTE LINE

- STORM DRAIN LEGEND**
- STORM DRAIN MANHOLE & NO.
  - CATCH BASIN
  - STORM SEWER LINE
  - MATERIALS:**  
RC — REINFORCED CONCRETE

NOTE: PARCEL BOUNDARIES ARE APPROXIMATE.



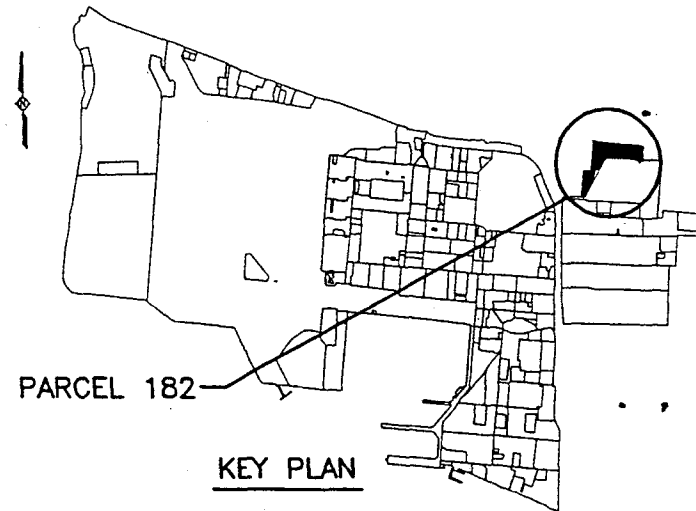
**DRAFT**

EBS PHASE 2B  
FIGURE 182-4  
PARCEL 182  
MOTOR OIL CONCENTRATIONS IN SOIL

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GENERAL LEGEND

- PARCEL OUTLINE
- HYDROPUNCH SAMPLING LOCATION
- HYDROPUNCH AND SURFACE SAMPLING LOCATIONS
- SURFACE AND SUBSURFACE SOIL AND HYDROPUNCH SAMPLING LOCATIONS
- 2B- SURFACE SOIL SAMPLING LOCATION
- SURFACE AND SUBSURFACE SOIL SAMPLING LOCATIONS
- SUBSURFACE SOIL SAMPLING LOCATION
- ⊗ SUBSURFACE SOIL AND HYDROPUNCH SAMPLING LOCATIONS
- ◇ SUBSURFACE SOIL SAMPLE
- 2A- ○ SURFACE SOIL SAMPLE
- ⊙ SOIL GAS SAMPLE
- ⊕ PHASE 2A TARGET AREA

FUEL LINE LEGEND

- FUEL LINES ABANDONED
- FUEL LINES IN USE

SANITARY SEWER LINE LEGEND

- 10 ■ SANITARY SEWER MANHOLE NO.
- GREASE TRAP
- SW — SANITARY SEWER LINE

MATERIALS:

C.I. — CAST IRON

NOTES:

1. ALL SANITARY SEWERS ARE VITRIFIED CLAY PIPE UNLESS NOTED OTHERWISE.

INDUSTRIAL WASTE LINE LEGEND

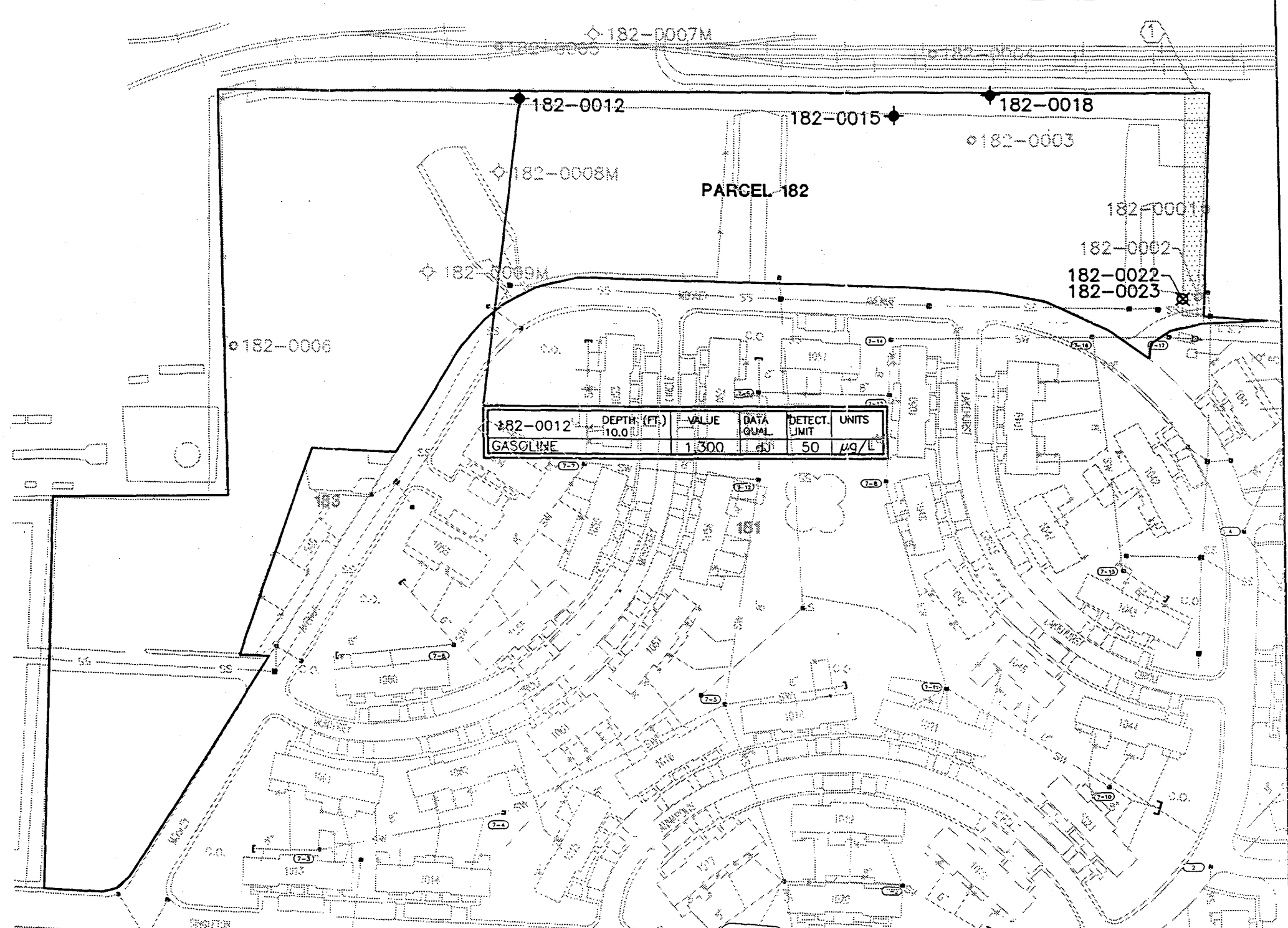
- INDUSTRIAL WASTE MANHOLE & NO.
- IW — INDUSTRIAL WASTE LINE

STORM DRAIN LEGEND

- 12A-1 ■ STORM DRAIN MANHOLE & NO.
- CATCH BASIN
- SS — STORM SEWER LINE

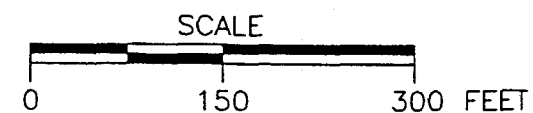
MATERIALS:

RC — REINFORCED CONCRETE



NOTES:

1. 2B DETECTIONS ARE INDICATED BY DOUBLED BOX.
2. PARCEL BOUNDARIES ARE APPROXIMATE.



**DRAFT**

EBS PHASE 2B  
 FIGURE 182-5

PARCEL 182  
 TPH CONCENTRATIONS IN GROUNDWATER

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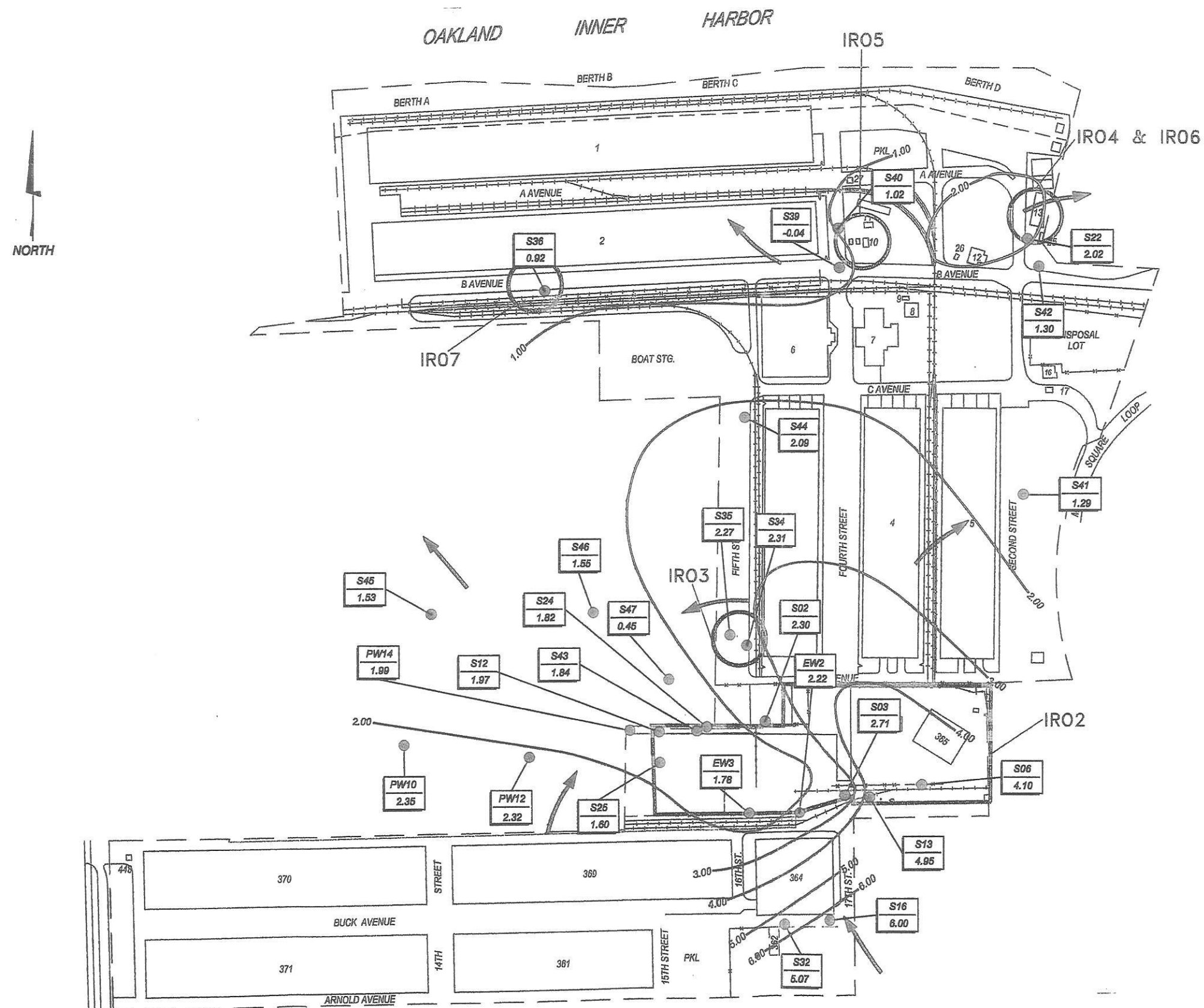


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**ATTACHMENT B**

**ALAMEDA ANNEX GROUNDWATER INVESTIGATION RESULTS**



## LEGEND

- S20** — MONITORING WELL NUMBER
- 7.11** — GROUNDWATER ELEVATION (FEET IN MSL)
- — MONITORING WELL USED FOR CONTOUR MAP
- 1.00 — GROUNDWATER ELEVATION CONTOUR LINE (FEET ABOVE MEAN SEA LEVEL)
- — GROUNDWATER FLOW DIRECTION

**SCALE IN FEET**

0 100 200 400

FLEET AND INDUSTRIAL SUPPLY CENTER, OAKLAND  
ALAMEDA FACILITY/ALAMEDA ANNEX SITE

**FIGURE 4-8**  
**GROUNDWATER ELEVATION CONTOUR MAP**  
**NINTH MONITORING EVENT**  
**(OCTOBER 1996)**

**TETRA TECH EM INC.**

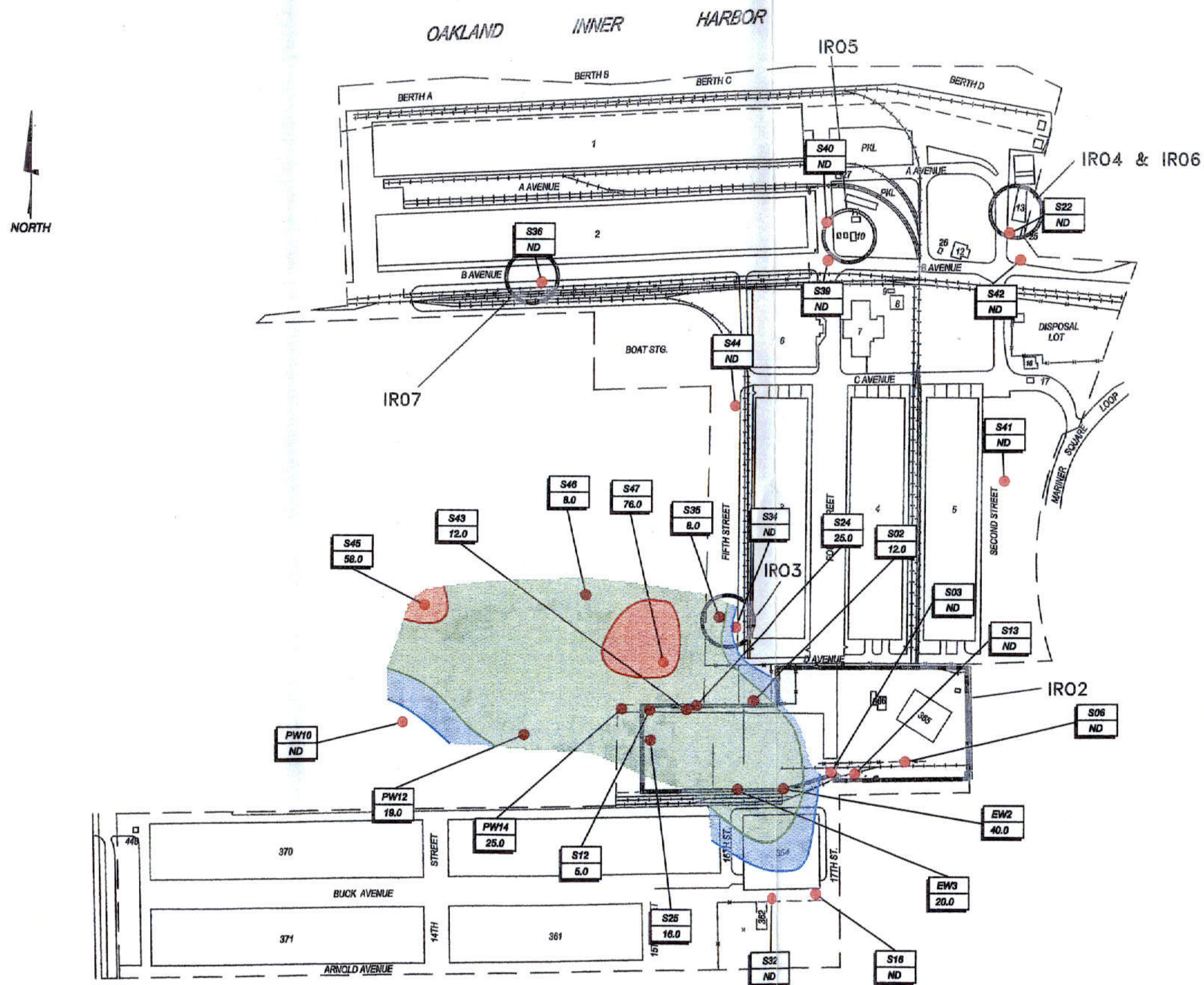








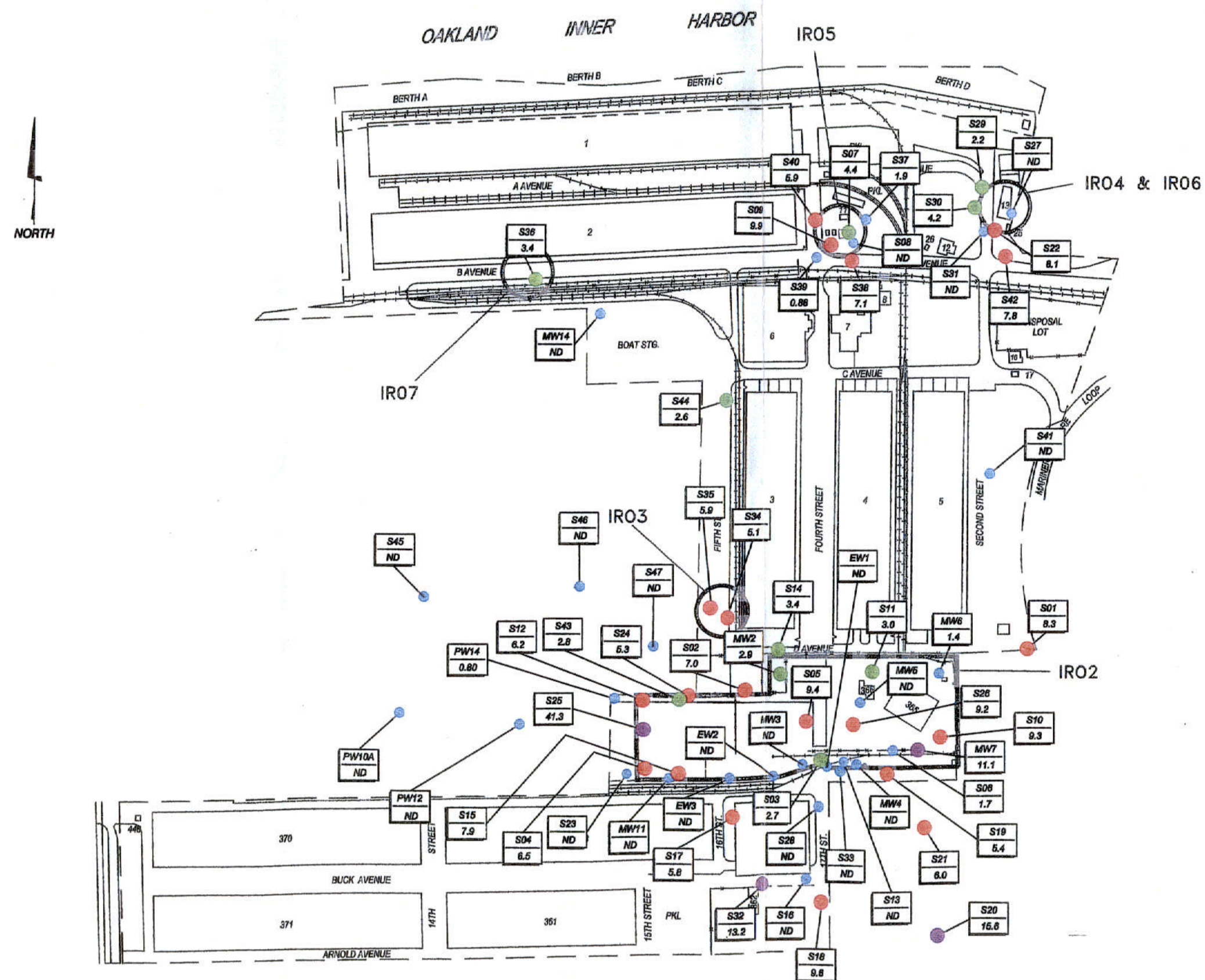












FLEET AND INDUSTRIAL SUPPLY CENTER, OAKLAND  
ALAMEDA FACILITY/ALAMEDA ANNEX SITE

FIGURE 5-31

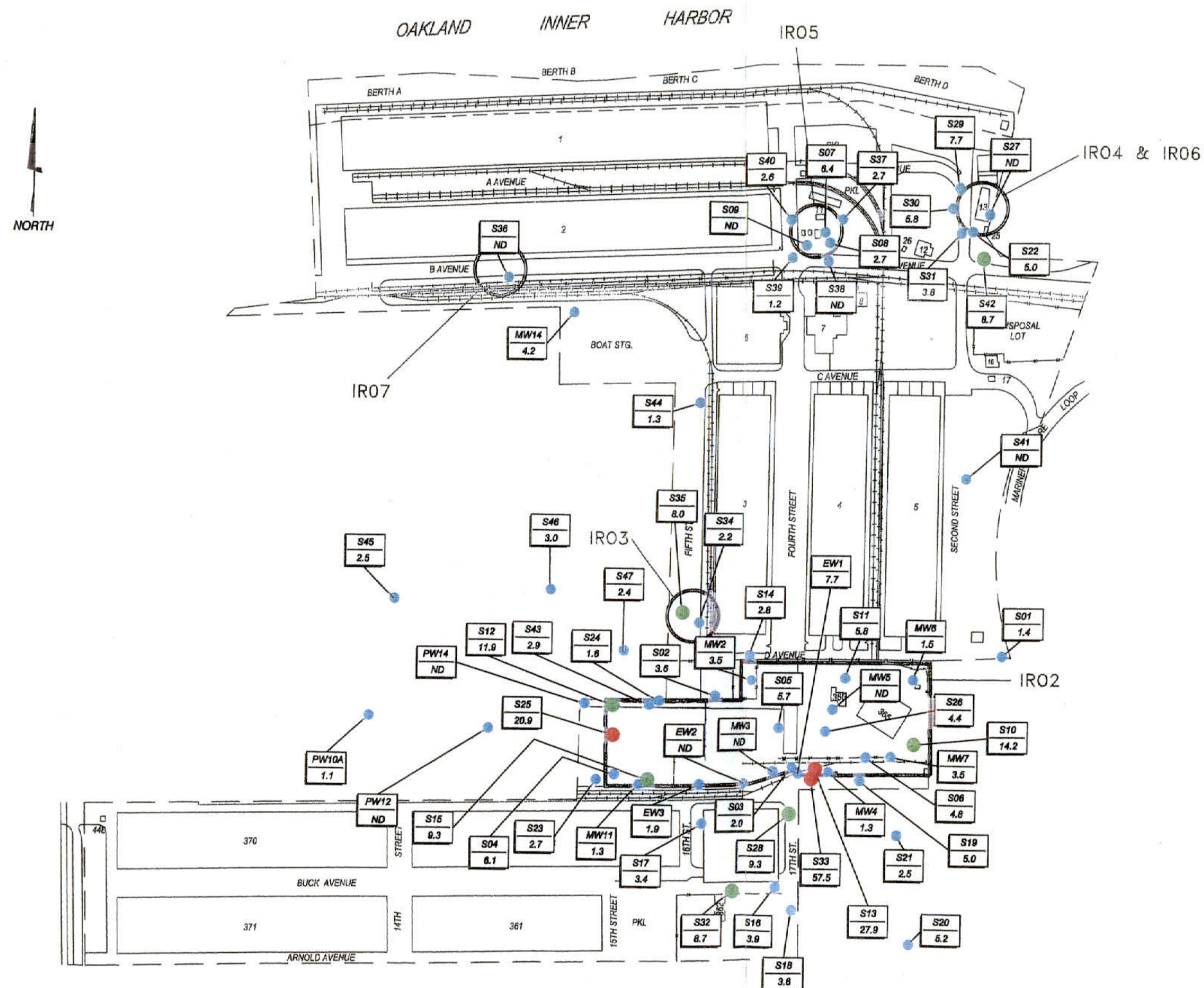
MAXIMUM COPPER CONCENTRATIONS  
DETECTED IN GROUNDWATER

TETRA TECH EM INC.









FLEET AND INDUSTRIAL SUPPLY CENTER, OAKLAND  
ALAMEDA FACILITY/ALAMEDA ANNEX SITE

FIGURE 5-33

MAXIMUM NICKEL CONCENTRATIONS  
DETECTED IN GROUNDWATER

TETRA TECH EM INC.